AD A023254

PRODUCTION ENGINEERING MEASURE FOR IMPROVED RELIABILITY OF METALLIZED POLYCARBONATE CAPACITORS

(12)

FINAL REPORT

PERIOD: JUNE 8, 1967 -JANUARY 28, 1976

TO

U. S. ARMY ELECTRONICS COMMAND

FORT MONMOUTH, NEW JERSEY

CONTRACT NO. DAAB05-67-C-2707

A

Approved for public release; distribution unlimited.

SPRAGUE ELECTRIC COMPANY

NORTH ADAMS, MASSACHUSETTS

Unclassified

Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) Sprague Electric Company North Adams, Massachusetts 01247	2a. REPORT SECURITY CLASSIFICATION Unclassified 2b. GROUP

3. REPORT TITLE

Production Engineering Measure For Improved Reliability of Metallized Polycarbonate and Metallized Polysulfone Capacitors

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

Final Report, Period June 8, 1967 - January 28, 1976

5. AUTHOR(S) (First name, middle initial, last name)

Adelson, Leonard

6. REPORT DATE February 1976	7a. TOTAL NO. OF PAGES 348	7b. NO. OF REFS
8a. CONTRACT OR GRANT NO. DAAB05-67-C-2707 b. PROJECT NO. c. d.	9a. ORIGINATOR'S REPORT NUMBER(S) A120-38 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)	

10. DISTRIBUTION STATEMENT

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY U. S. Army Electronics Command Fort Monmouth, New Jersey 07703 Attn: AMSEL-PP-I-P-I-1

13. ABSTRACT

The objective of the work program for process improvement and testing of production lots of metallized polycarbonate film and metallized polysulfone film hermetically sealed capacitors was to a failure rate under static test conditions with a goal of .002% per 1000 hours for each dielectric, based on testing 11,500 of each for 10,000 hours. The original contract goal had been .001% per 1000 hours based on testing 23,000 metallized polycarbonate film capacitors. However, the contract modification deleting 11,500 of metallized polycarbonate film capacitors and substituting 11,500 of metallized polysulfone film capacitors changed the maximum attainable FR for each dielectric to .002% per 1000 hours. In particular, effort was concentrated in the process improvement phase in these areas:

(a) Quality of metallized films
(b) Heat Treatment of capacitor sections
(c) Shrinkage of film
(d) Solvent entrapment within the film
(e) Burn-in of the completed capacitor

Information pertinent to the process factors evaluated and results obtained in each area are detailed and the engineering decisions incorporated into the pre-production and production lots are delineated.

Units were tested in conventional oven chambers with special inserts for mounting capacitors at rated voltage at 125°C for 10,000 hours. Tests resulted

(over)

DD FORM 1 NOV 65 1473

Unclassified

Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
in a calculated failure rate of .002% per 1000 hours for the metallized polycarbonate film capacitors and .0056% per 1000 hours for the metallized polysulfone film capacitors due to one (1) failure at 1000 hours and termination of the entire test at 6000 hours due to test equipment malfunction.						

PRODUCTION ENGINEERING MEASURE

FOR IMPROVED RELIABILITY

OF METALLIZED POLYCARBONATE AND

METALLIZED POLYSULFONE CAPACITORS

FINAL REPORT

Period: June 8, 1967 - January 28, 1976

Object of Study: The object of this production engineering measure is to improve production techniques for the manufacture of Metallized Polycarbonate and Metallized Polysulfone Capacitors to attain a maximum failure rate of 0.001% per 1000 hours with a 90% confidence level.

U. S. ARMY ELECTRONICS COMMAND

Fort Monmouth, New Jersey 07703

Contract No. DAAB05-67-C-2707

Report Prepared by:

Leonard Adelson

Report Approved by:

W. C. Donelan
J. Fisher

SPRAGUE ELECTRIC COMPANY
North Adams, Massachusetts 01247

Approved for public release; distribution unlimited.

TABLE OF CONTENTS

TABLE OF CONTENTS (CONT'D)

LIST OF TABLES

LIST OF TABLES (CONT'D)

LIST OF TABLES (CONT'D)

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (CONT'D)

SECTION 1

ABSTRACT

The objective of the work program for process improvement and testing of production lots of metallized polycarbonate film and metallized polysulfone film hermetically sealed capacitors was to a failure rate under static test conditions with a goal of .002% per 1000 hours for each dielectric, based on testing 11,500 of each for 10,000 hours. The original contract goal had been .001% per 1000 hours based on testing 23,000 metallized polycarbonate film capacitors. However, the contract modification deleting 11,500 of metallized polycarbonate film capacitors and substituting 11,500 of metallized polysulfone film capacitors changed the maximum attainable FR for each dielectric to .002% per 1000 hours. In particular, effort was concentrated in the process improvement phase in these areas:

(a) Quality of metallized films

(b) Heat Treatment of capacitor sections

(c) Shrinkage of film

(d) Solvent entrapment within the film

(e) Burn-in of the completed capacitor.

Information pertinent to the process factors evaluated and results obtained in each area are detailed and the engineering decisions incorporated into the pre-production and production lots are delineated.

Units were tested in conventional oven chambers with special inserts for mounting capacitors at rated voltage at 125°C for 10,000 hours. Tests resulted in a calculated failure rate of .002% per 1000 hours for the metallized polycarbonate film capacitors and .0056% per 1000 hours for the metallized polysulfone film capacitors due to one (1) failure at 1000 hours and termination of the entire test at 6000 hours due to test equipment malfunction.

SECTION 2

PURPOSE

The purpose of this Production Engineering Measure is as follows:

(1) To provide the production engineering necessary to improve production techniques for increasing the reliability of metallized polycarbonate capacitors and metallized polysulfone capacitors.

(2) To conduct process improvement studies with the aim of meeting a reliability level of 0.001% maximum allowable failure rate per 1000 hours with 90% confidence level when tested at rated conditions. The processes to be improved encompass the following:

(a) Incoming inspection of material and quality of metallized polycarbonate film and metallized polysulfone film

(b) Heat treatment

(c) Excessive shrinkage of film

(d) Solvent entrapment

(e) Burn-in.

(3) Perform all necessary matrix tests to demonstrate the capability of the improved production line and to verify reliability.

(4) To Prepare and submit a management evaluation program, such as PERT, or an equivalent of approximately 75 elements, describing the work to be performed.

(5) To manufacture and submit for approval 560 Preproduction Samples of Metallized Polycarbonate capacitors, and 256 Preproduction Samples of Metallized Polysulfone capacitors, prior to their respective Production runs.

(6) To design, develop and manufacture or procure all special tooling necessary for the success of the Production Runs.

(7) To design, procure, or fabricate limited production equipment (on a one-of-a-kind basis) capable of manufacturing 3000 units per eight-hour shift.

(8) To prepare, prior to the Production Runs, an Inspection and Quality Control Plan in the form of a manual describing the in-process and end item inspection and Quality Control techniques to be used in the production of the capacitors.

(9) To perform Production Runs consisting of 23,000 units meeting specification MIL-C-39022 and Technical Requirement SCS-301 each of which is to be life tested for 10,000 hours. The Metallized Polycarbonate Production Run shall consist of the following:

Contract Item No.	Rating	Type	Production Run Quantity
1AL	0.10 mfd - 100V	SCS-301B104K	1925
1AM	1.0 mfd - 100V	SCS-301B105K	1925
1AN	4.0 mfd - 100V	SCS-301B405K	1925
1AP	0.047 mfd - 200V	SCS-301C473K	1925
1AQ	0.33 mfd - 200V	SCS-301C334K	1925
1AR	1.0 mfd - 200V	SCS-301C105K	1925

The Metallized Polysulfone Production Run shall consist of the following:

Contract Item No.	Rating	Type	Production Run Quantity
1BL	0.10 mfd - 100V	SCS-301B104K	1925
1BM	1.0 mfd - 100V	SCS-301B105K	1925
1BN	4.0 mfd - 100V	SCS-301B405K	1925
1BP	0.047 mfd - 200V	SCS-301C473K	1925
1BQ	0.33 mfd - 200V	SCS-301C334K	1925
1BR	1.0 mfd - 200V	SCS-301C105K	1925

(10) To prepare a General Step II Report describing the production facility having an expansion capability to 6000 units per eight-hour day.

(11) To prepare and submit monthly reports, quarterly reports, a final engineering report, and bills of materials and parts.

SECTION 3

NARRATIVE AND DATA

3.1 General

The object of this Production Engineering Measure was to improve process and production techniques for the manufacture of Metallized Polycarbonate and Metallized Polysulfone Capacitors which under test would demonstrate a maximum failure rate of 0.002 percent per thousand hours at a 90% confidence level. The processes to be improved were Quality of Metallized Polycarbonate and Polysulfone Film, Heat Treatment of Capacitor Section, Shrinkage of Film, Removal of Entrapped Solvent, and Burn-in.

The capacitors were to conform to the requirements of specification MIL-C-39022 dated 6 February 1967, Electronics Command Technical Requirements SCS-301 with Amendment 1, dated 6 February 1967 and Electronics Command Technical Specification Sheet SCS-301/1 as applicable.

To achieve the objective of 0.002% failure rate it would be necessary to manufacture 11,500 capacitors of each dielectric

in accordance wi '· the applicable specification. These capacitors would then be tested for 10,000 hours at rated voltage at +125°C. Zero failures in the resulting 115 million unit hours for each film would achieve the reliability level of .002%/1K hours pe. MIL-STD-690. If both types were combined, 001% per 1000 hours could be demonstrated. However, since there is no compatibility in the two dielectrics, such combination would be meaningless.

This Production Engineering Measure was divided into two parts. The first part consisted of process improvement, evaluation, manufacture, and testing of a minimum of 11,500 Metallized Polycarbonate Film Capacitors. The second part consisted of process improvement, evaluation, manufacture, and testing of a minimum of 11,500 Metallized Polysulfone Film Capacitors.

Testing of 11,500 capacitors with no failures for 10,000 hours at 125°C and rated voltage would produce a failure rate of 0.002% per thousand hours at a 90% confidence level.

Part 2 of the contract provided an opportunity for proving the feasibility of the use of Polysulfone film as a viable dielectric for the metallized capacitor system.

The work to be accomplished under this contract was divided into area of effort goals or phases. These phases were established based on the effort to be expended in each of portions of the overall program with a sequential flow of phase 1 through phase 5. Table I delineates the phase selection for the Metallized Polycarbonate program and Table II delineates the phase selection for the Metallized Polysulfone program.

3.2 Description of Capacitor

The capacitors for this Production Engineering Measure were electrostatic capacitors using either metallized polycarbonate or metallized polysulfone film obtained from a domestic source as the dielectric and electrodes. The nominal thicknesses for both films were 0.00025 and 0.00050 inches.

Two continuous layers of metallized film were concentrically wound to form a cylindrical section (Figure 1). The section was terminated with lead wires, assembled into a tinned brass tube, potted, and hermetically sealed. A cross-section of the assembly is projected in Figure 2. Six metallized polycarbonate capacitor ratings were manufactured in conformance with the electrical parameters and mechanical dimensions detailed in Figure 3. Six metallized polysulfone ratings were manufactured in conformance with the electrical and mechanical dimensions detailed in Figure 4.

TABLE I

PRODUCTION ENGINEERING MEASURE - PROGRAM PHASES FOR METALLIZED POLYCARBONATE CAPACITORS

Contract Phase	Phase Effort
Phase 1	Process Improvements
Phase 2	Evaluation and Test of Process Improvements
Phase 3	Re-evaluation of Sources and Process Improvements
Phase 4	First Article Tests - Electrical and Environmental per MIL-C-39022 Table IX
Phase 5	Production Run and 10, 000 hour test of 11, 500 capacitors.

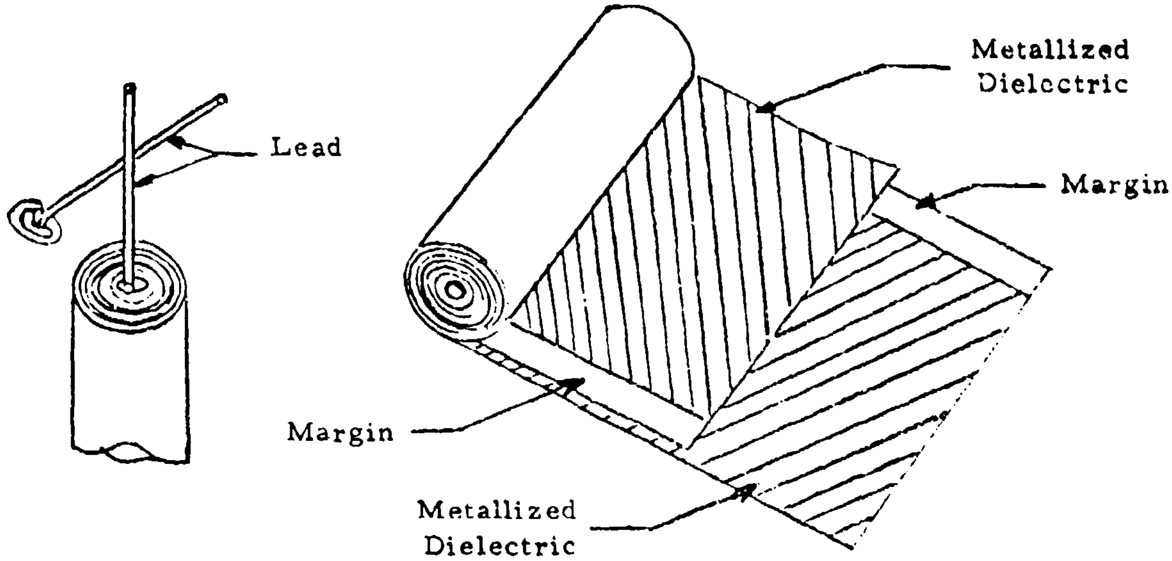
Note: Phases to be performed sequentially to completion.

TABLE II

PRODUCTION ENGINEERING MEASURE - PROGRAM PHASES FOR METALLIZED POLYSULFONE CAPACITORS

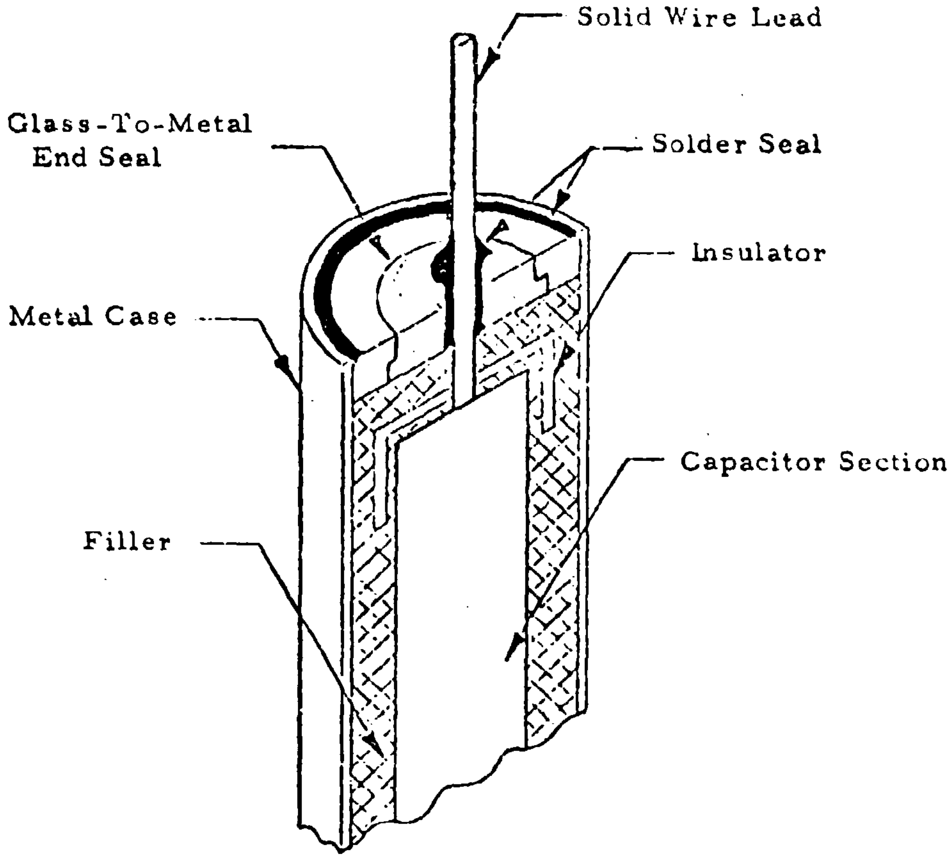
Contract Phase	Phase Effort
Phase 1	Process Improvements
Phase 2	Test and Evaluation of Process Improvements
Phase 3	First Article Tests - Electrical and Environmental per MIL-C-39022 Table IX
Phase 4	Production Run and 10,000 hour test of 11,500 capacitors.

Note: Phases to be performed sequentially to completion.



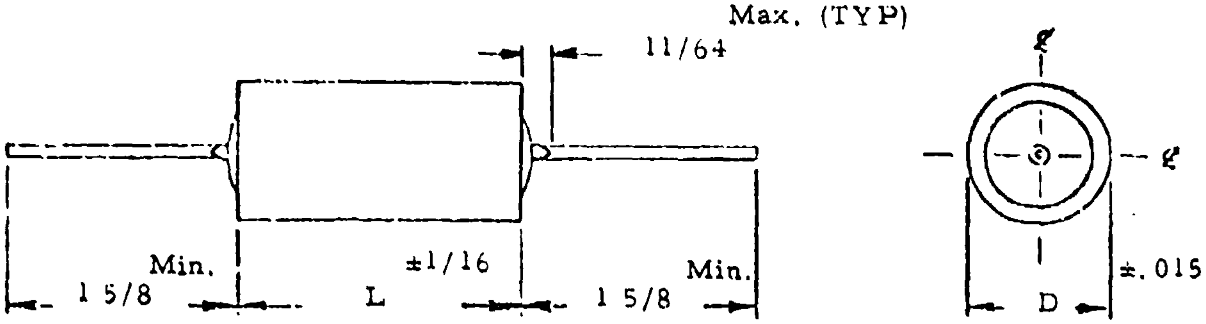
METALLIZED CAPACITOR SECTION

Figure 1



CROSS-SECTION VIEW OF METALLIZED POLYCARBONATE AND METALLIZED POLYSULFONE CAPACITORS

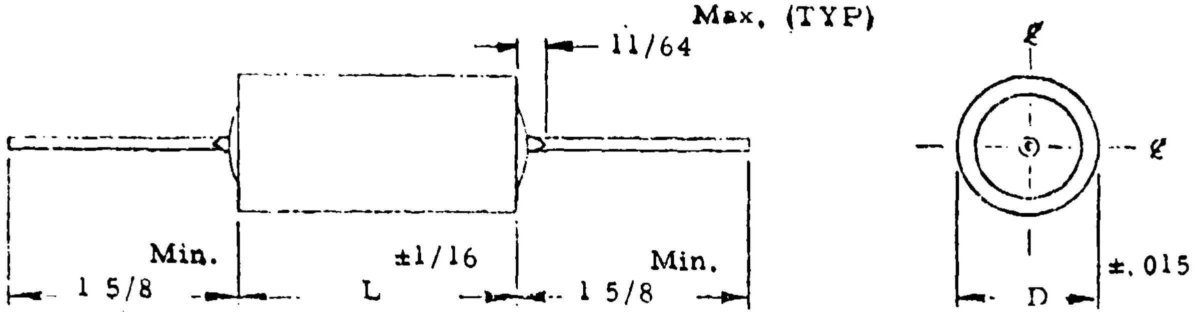
Figure 2



PART NUMBER	CAP ±10%	VOLTAGE RATING	D	L	LEAD AWG
SCS301B104K	0.1	100VDC	.312	13/16	#22
SCS301B105K	1.0	100VDC	.562	1 5/16	#20
SCS301B405K	4.0	100VDC	.750	2 1/16	#20
SCS301C473K	0.047	200VDC	.400	13/16	#20
SCS301C334K	0.33	200VDC	.562	1 9/16	#20
SCS301C105K	1.0	200VDC	.750	2 1/16	#20

DIMENSIONS OF METALLIZED POLYCARBONATE CAPACITORS

Figure 3



PART NUMBER	CAP ±10%	VOLTAGE RATING	D	L	LEAD AWG
SCS301B104K	0.1	100VDC	.312	13/16	#22
SCS301B105K	1.0	100VDC	.562	1 5/16	#20
SCS301B405K	4.0	100VDC	.750	2 1/16	#20
SCS301C473K	0.047	200VDC	.400	13/16	#20
SCS301C334K	0.33	200VDC	.562	1 9/16	#20
SCS301C105K	1.0	200VDC	.750	2 1/16	#20

DIMENSIONS OF METALLIZED POLYSULFONE CAPACITORS

Figure 4

The combination of thin organic plastic film dielectric with metallized electrodes provided the maximum volumetric efficiency. Added to this was the 125°C operating capability and the superior electrical properties inherent in polycarbonate film. Established reliability of the subminiature metallized polycarbonate capacitor as a consequence of this Production Engineering Measure completed the requirements that are of particular importance to the designer of reliable electronic equipment where space is at a premium.

These same considerations, as they applied to Polysulfone film, plus the potential of polysulfone film as a result of the film's superior high temperature characteristics promised increased reliability of metallized film capacitors.

As previously stated, this Production Engineering Measure encompasses two distinctly different dielectric film materials, namely Metallized Polycarbonate and Metallized Polysulfone. Starting with Paragraph 3.3, Section 3 has been divided into two parts: Part 1 covers the Metallized Polycarbonate Capacitors and Part 2 covers the Metallized Polysulfone Capacitors.

PART 1

THE METALLIZED POLYCARBONATE FILM CAPACITOR

3.3 Process Improvement Phase 1

The conditions or processes evaluated are as follows:

(a) Quality of Metallized Polycarbonate Film as received

(b) Shrinkage of film

(c) Heat treatment of capacitor section

(d) Removal of entrapped solvent

(e) Burn-in.

3.3.1 Film Manufacture and Source

At the inception of this Production Engineering Measure there was one domestic supplier of thin gauge capacitor grade metallized polycarbonate film. Our first objective was to obtain a suitable source with the expertise to improve film quality so that the contract objective of low failure rate metallized polycarbonate capacitors was feasible. Film quality was dictated by the state-of-the-art and the capability of the domestic manufacturer.

Three dielectric film manufacturers were engaged to supply material for Phase 1 of the contract. They were designated as follows:

Source A Domestic

Source B Foreign

Source C Domestic

The film supplied by Source A was manufactured by the extrusion process. This process consists of forcing molten plastic through a die. The major limitations of this process when considering ultra-thin films for use as capacitor dielectrics are variations in thickness, the probability of holes and thin spots, and the inclusion of polymer gels and particulate matter.

Source B was an established foreign manufacturer whose film would be used in the initial phases of the contract as a yardstick for comparison of quality and performance.

Domestic Source C supplied a film made by the solvent casting process similar to that manufactured by Source B. Solvent casting provided the potential for excellent gauge control and the manufacture of very thin films. The major limitation of this process was the high probability of entrapped solvent. Special consideration was given to this factor in the improvement of the capacitor manufacturing process.

3.3.2 Quality of Film as Received

A comprehensive incoming inspection was performed on both the .00025 inch and the .00050 inch gauge metallized polycarbonate films received from the three sources and intended for use in the process improvement evaluation phase of the contract. The characteristics examined were film width, margin width, film thickness and metal electrode thickness (resistance of metallization in both the transverse and machine directions). In addition, a visual inspection was conducted on the general condition of the rolls including wrinkles, holes, alignment, and splices.

In thin dielectric films wrinkling can be of extreme concern since inclusion of wrinkles in the rolled section can lead to both excessive mechanical and electrical stress concentrated in small areas resulting in early failure. Particular attention was given to this factor in performing the inspection of the rolls of dielectric as received. The material received from Source B and Source C was acceptable. Of the twenty-two rolls received from Source A, four rolls exhibited wrinkling. Inspection for wrinkles involved a relatively few number of turns on the outside of the rolls. It was anticipated that wrinkles were present further into a majority of the rolls from Source A that were "apparently acceptable" at incoming inspection.

An additional factor of concern was the uniformity of clear edge i.e. that portion of the dielectric film surface free of metallization

and providing adequate isolation of the adjacent electrodes when concentrically wound and depicted in Figure 1 as Margin. One roll of material from Source A exhibited a margin width below the acceptable tolerance of ±1/64 inch. One roll of material from Source B exhibited a margin wider than the acceptable tolerance which was not considered to be a major discrepancy since quality and performance would not be impaired.

Metallization or metal electrode thickness was important in terms of ultimate parameter performance and life characteristics of the capacitors. Thin metallization results in high resistivity expressed in ohms per square with typically an increase in DF due to I^2R losses. In addition, the leads which are attached by a metal end spray process to the ends of the capacitor sections bonding to the metallization, make a high resistance termination with a consequent increase in DF and the possibility of open circuit due to loss of adhesion to the metallization. However, metallization that is too thick will result in a section which will not clear properly under excess stress or the necessary fault clearing during processing resulting in a short circuited device or severe degradation in insulation resistance. Metal electrode thickness was found to be acceptable for the material from all three sources. However, the 1.75 inch wide film supplied by Source A exhibited marginally thick metallization in the transverse direction, an indication of possible short and IR problems with capacitor sections made from this material.

Film thickness and tolerances are important both in terms of ultimate capacitor performance and in yield. Thin gauge film could affect the film dielectric strength, electrical performance of the capacitor, and reliability. Gauge variations and thick film could cause losses due to capacitance tolerance and physical size rejects. Four of the rolls of film supplied by Source A exhibited heavy gauge while two other rolls showed a variation in gauge in the transverse direction.

The metallized polycarbonate film from suppliers B and C was satisfactory. That supplied by Source A (the extruded film) was found to have both major and minor discrepancies. Tables III and IV present the results of the incoming inspection performed on material supplied by Sources A and B respectively.

It was necessary to develop a process for manufacture of capacitors from these films which eliminated or corrected those capacitors with intrinsic defects inherent in the metallized films. The necessary sequence in this situation was development of a satisfactory section design, process, and finished component burn-in.

3.3.3 Film Shrinkage

A common effect of the manufacture of thin continuous polymeric films has been the introduction of mechanical stress, or orientation, primarily in the machine direction but sometimes also in

TABLE III

INCOMING INSPECTION OF METALLIZED POLYCARBONATE
FROM DOMESTIC SOURCE A

Material	Nominal Gauge	Roll No.	Actual Measurements of Width(in)	Actual Measurements of Margin(in)	Actual Measurements of Thickness(mil)	Metallization Thickness in ohms per square Machine Direction	Metallization Thickness in ohms per square Transverse Direction	Comments
Polycarbonate Film from domestic source	0.25	1	0.50	.062	0.24	1.41	1.83	OK
		2	0.50	.062	0.25	1.41	1.83	OK
		3	0.50	.062	0.24	1.74	1.37	Wrinkles
		4	0.50	.062	0.30	1.74	1.82	Heavy Gauge
		5	1.75	.062	0.25	1.36	0.95	OK
		6	1.75	.046	0.29 - 0.35	1.29	0.95	Heavy Gauge
		7	1.75	.062	0.25	1.36	0.95	OK
		8	1.75	.062	0.25 - 0.28	1.71	0.89	Ga. var.*
		9	1.75	.062	0.25	1.57	0.95	OK
		10	1.75	.031	0.25 - 0.27	1.43	0.83	Narrow Mar.
		11	1.75	.062	0.26 - 0.32	2.57	1.66	Heavy Gauge
		12	1.75	.062	0.24	1.72	1.07	OK
		13	0.50	.062	0.52	1.87	1.83	OK
		14	0.50	.062	0.55	1.85	1.83	OK
		15	0.50	.062	0.55 - 0.60	1.30	1.60	Heavy Gauge
		16	0.50	.062	0.50	1.48	1.37	OK
		17	1.75	.062	0.50	1.29	0.95	Wrinkles
		18	1.75	.062	0.51	1.21	0.95	Wrinkles
		19	1.75	.062	0.52 - 0.56	1.14	0.83	Ga. var.*
		20	1.75	.062	0.52 - 0.56	1.21	0.83	Ga. var.*
		21	1.75	.062	0.50	1.43	0.89	OK
		22	1.75	.062	0.50 - 0.53	1.43	0.95	Wrinkles

*Gauge Variations were in the transverse direction.

TABLE IV

INCOMING INSPECTION OF METALLIZED POLYCARBONATE
FROM FOREIGN SOURCE B

Material	Nominal Gauge	Roll No.	Actual Measurements of Width(in)	Actual Measurements of Margin(in)	Actual Measurements of Thickness(mil)	Metallization Thickness in ohms per square Machine Direction	Metallization Thickness in ohms per square Transverse Direction	Comments
Polycarbo-nate Film from non-domestic source	0.24	1	0.50	.062	0.25	1.85	2.05	OK
		2	0.50	.062	0.26	1.19	1.37	OK
		3	1.75	.062	0.24	1.50	1.01	OK
		4	1.75	.062	0.25	1.36	1.01	OK
		5	1.75	.062	0.24	1.71	1.30	OK
		6	1.75	.062	0.24	1.57	1.19	OK
	0.50	7	0.50	.062	0.54	1.48	2.28	OK
		8	0.48	.046	0.54	2.04	2.28	OK
		9	1.75	.093	0.50	1.86	1.13	Wide margin
		10	1.75	.062	0.49	2.14	1.36	OK
		11	1.75	.062	0.50	1.43	0.95	OK
		12	1.75	.062	0.50	1.36	1.07	OK

the transverse direction of the film. This stress or stretch has often been purposely introduced to enhance film tensile strength or to take advantage of stress relief in the form of film shrinkage. Heating and exposure to solvents are methods that have been used to "shrink" plastic films.

Capacitance stability of a polycarbonate film capacitor as a function of time and temperature stress conditions considered normal in typical applications is achieved when the inherent shrinkage of the film occurs after the winding of the section and before finishing into a completed encased capacitor.

However film in which the shrink factor is too great or which does not readily stabilize after exposure to temperatures equivalent to the maximum operating temperature of the capacitor will result in a capacitor which does not exhibit the desired long term stability with time and temperature.

The temperature selected for evaluation of the film shrinkage was a graduated temperature exposure of one hour duration in an oven with the temperature increased from a starting level of 85°C to a maximum of 150°C in 5°C increments. Three inch lengths of the 1.75 inch wide metallized film from the three sources were suspended in an oven. Shrinkage was observed during the exposure period.

Figures 5 and 6 demonstrate in graph form the percent shrinkage as a function of temperature of the films from Sources A and B. There was no detectable shrinkage up through 135°C for either film. The extruded film from Source A exhibited significant shrinkage in both the machine and the transverse directions above 135°C. The cast film from Source B did not shrink in the transverse direction and shrunk from 2% to 2 1/2% in the machine direction.

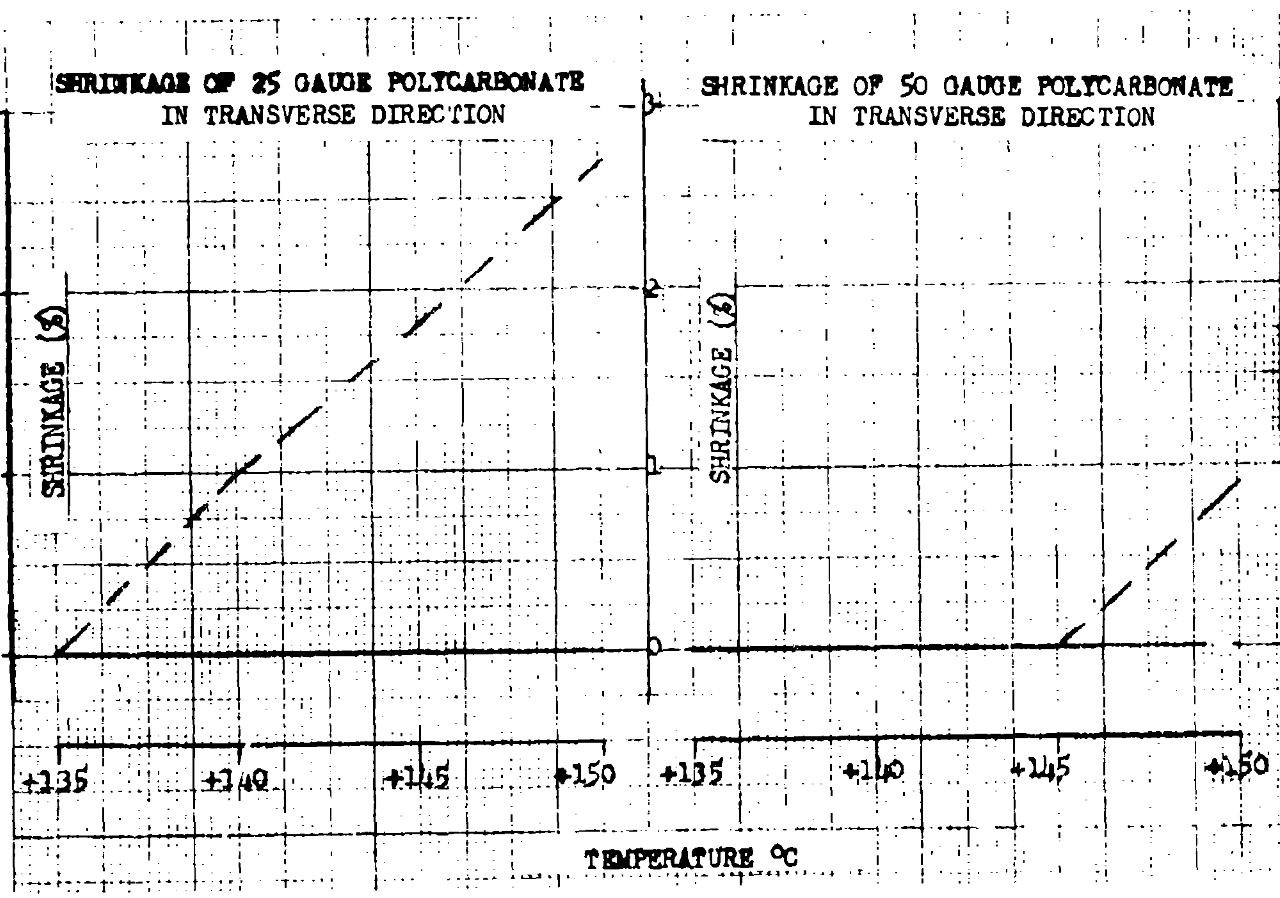
Table V presents additional shrinkage test data comparing materials from Sources B and C. Domestic source C compared favorably with foreign Source B. The maximum shrinkage of the C material was 4.3% at 150°C. This amount of shrinkage is an acceptable level.

The glass transition temperature of polycarbonate occurs at about 145°C. Examination of the data indicated that film shrinkage was consistent with this characteristic by shrinking most rapidly in the 140°C to 150°C range. The results of the test indicated that Source A material (extruded film) shrunk to an undersirable extent from the standpoint of process and performance, whereas the cast film from Source C was acceptable.

The stress present in the machine direction of the film was relieved by an effective heat treatment developed by a matrix of capacitor sections and temperature exposures. The resultant treatment was incorporated as

Figure 5

SHRINKAGE OF METALLIZED POLYCARBONATE
IN TRANSVERSE DIRECTION



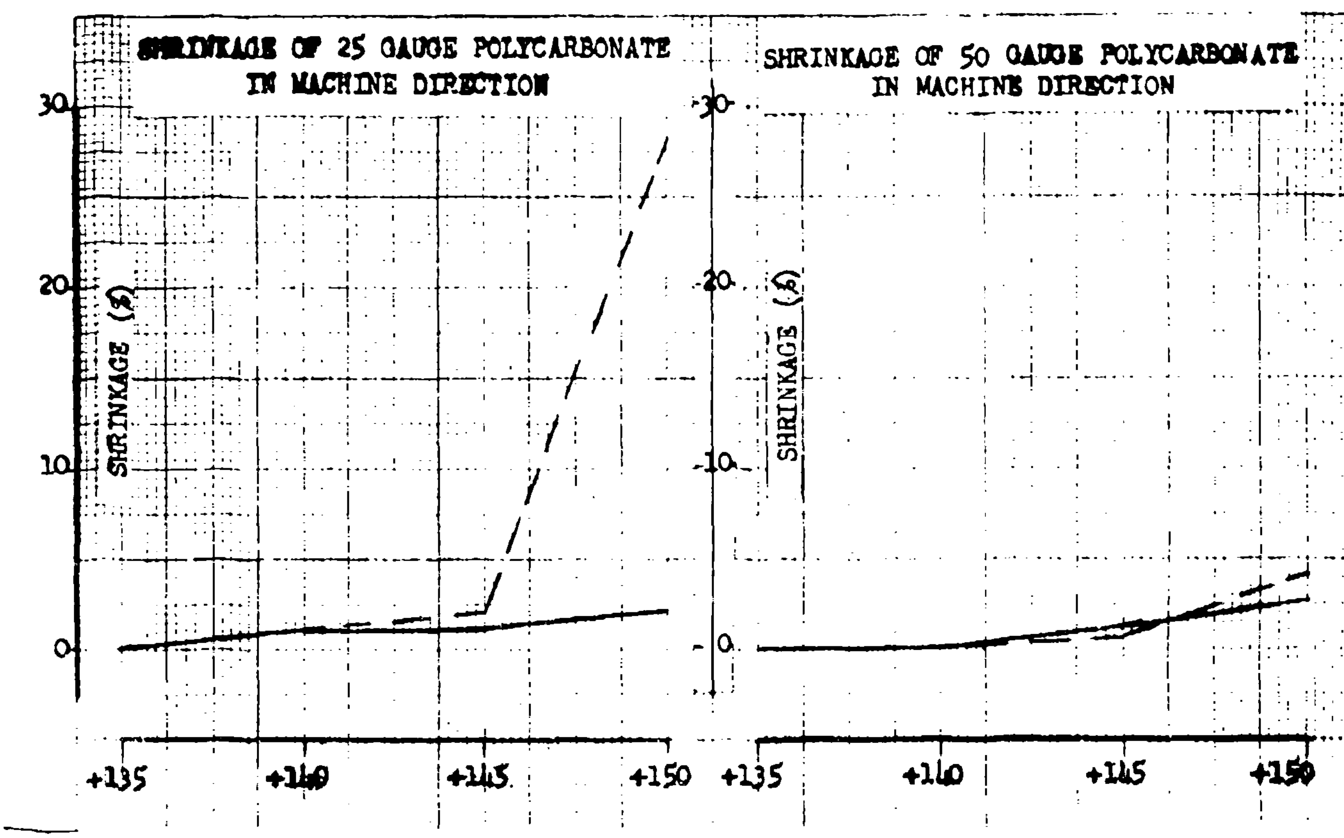
DOMESTIC SOURCE A: — — —

FOREIGN SOURCE B: ————

Figure 6

SHRINKAGE OF METALLIZED POLYCARBONATE

IN MACHINE DIRECTION



DOMESTIC SOURCE A: — — —

FOREIGN SOURCE B: ————

TABLE V

SHRINKAGE OF METALLIZED POLYCARBONATE FILM

Temp. (°C)	24 Gauge B Material	24 Gauge C Material	50 Gauge B Material	50 Gauge C Material
+125°C	NIL	NIL	NIL	1.1%
+130°C	0.5%	1.1%	0.5%	1.1%
+135°C	0.5%	1.1%	0.5%	1.1%
+140°C	1.1%	2.1%	1.1%	2.1%
+145°C	1.1%	2.1%	2.1%	3.2%
+150°C	2.1%	2.1%	3.2%	4.3%

Note 1: Shrinkage in machine direction determined by change in length of 3" strip after one hour at specified temperature.

Note 2: B Material - Source B
C Material - Source C

a requirement into the manufacturing process resulting in a capacitor with the desired stable characteristics. It was equally important to assure that the selected heat treatment did not damage either the metal continuity or the dielectric comprising the metallized polycarbonate film.

3.3.4 Section Winding

A total of 2000 metallized capacitor sections were required for the Process Evaluation phase of the contract. The breakdown of ratings, quantities, and material sources is presented in Table VI.

Sections were prepared by winding the metallized polycarbonate film on a small diameter mandrel to form a roll. During the winding, proper alignment and tension were maintained to ensure a capacitor section having necessary mechanical and electrical attributes. The number of turns, mandrel diameter, thickness of film, and winding tension control both the active area and diameter of the section. The width of film selected was that required to produce a finished section of the nominal capacitance required. The cut ends were secured to the roll with plastic tape and the section removed from the mandrel.

The capacitor sections were inspected for conformance of physical dimensions, margin variations, overall workmanship and capacitance. During the winding operations, wrinkles were encountered with the 0.50 inch wide film from Source A. Portions of the rolls were

TABLE VI

SECTION REQUIREMENTS FOR
PROCESS EVALUATION

Part No.	Capacitance and Voltage Rating	Material Source	Number of Sections
SCS-301B104K	0.10 μF - 100 VDC	A	200
		B	100
		C	200
SCS-301B405K	4.0 μF - 100 VDC	A	200
		B	100
		C	200
SCS-301C473K	0.047μF - 200 VDC	A	200
		B	100
		C	200
SCS-301C105K	1.0 μF - 200 VDC	A	200
		B	100
		C	200

so badly wrinkled as to render them unusable and much of the material had to be discarded. The section yield for Source A material was down to less than 50% as a consequence of the wrinkling. No significant problems were encountered during the winding of sections from material supplied by Sources B and C.

Provisions for wrinkle inspection were added as a part of the Incoming Acceptance criteria established which controlled this problem.

3.3.5 Heat Treatment of Sections

Polycarbonate film can contain trace quantities of residuals such as umpolymerized monomer, low molecular weight polymer, reaction by-products, degradation products, solvent, and absorbed moisture. Not only can these materials affect characteristics such as insulation resistance at both 25°C and the high operating ambient, in this case, 125°C, but they can contribute to accelerating end-of-life of an hermetically sealed capacitor. It is important to optimize capacitor quality and performance by removing these contaminants.

An effective section heat treatment could remove the entrapped solvent and undesirable residuals and condition the capacitor section for mechanical and electrical stability by causing stress relief or shrinkage. Of those capacitor sections wound for evaluation and Test Phases 1 and 2, 1280 sections were required to perform the test matrix to determine the most effective heat treatment. Thirty-

two capacitor sections of Material Source A of each rating listed in Table VI plus sixteen sections each of Material Sources B and C of each rating per Table VI, were subjected to each of the following five heat treatments.

(a)	Group 1 (256 sections):	Heat for 2 hours at 150°C
(b)	Group 2 (256 sections):	Heat for 4 hours at 150°C
(c)	Group 3 (256 sections):	Heat for 20 hours at 125°C
(d)	Group 4 (256 sections):	Heat for 18 hours at 125°C and a vacuum of less than 250 microns
(e)	Group 5 (256 sections):	Heat for 24 hours at 85°C followed by 12 hours at 100°C followed by 12 hours at 125°C.

Section testing after heat treatment consisted of dielectric strength, capacitance, dissipation factor, and insulation resistance at 25°C. The test conditions and limits were as follows:

Dielectric Strength:	2x rated voltage
Capacitance:	±10% of nominal
Dissipation Factor:	0.30% maximum
Insulation Resistance:	500,000 megohms or 100,000 megohms x mfd minimum.

The 4.0 mfd - 100V sections made with material from domestic Source A and exposed to the Groups 1 and 2 heat treatments exhibited excessive shrinkage and failed the 25°C section dielectric strength test at 200VDC. This result was consistent with the high film

shrinkage noted for the Source A material at 150°C in Section 3.3.3. Further evaluation of these two groups was discontinued. Therefore, Groups 1 and 2 are not listed in Table VII.

There were no rejects in those sections made from foreign Source B material or from domestic Source C material. Of the 384 sections remaining from the domestic Source A parts, 93 sections or 24% had low insulation resistance. The results tabulated in Table VII demonstrated that the incidence of low insulation resistance tended to increase with increasing size and that no significant differences were as yet evident as a function of Heat Treatment.

Additional sections were heat treated to replace the electrical rejects reported in Table VII.

3.3.6 Heat Aging

An investigation was made of the effects of a long-term section heat conditioning or "Heat Aging" on the capacitance stability and general performance of the metallized polycarbonate capacitor. One half of the sections made from Source A and Source B material and heat treated per section 3.3.5 were aged for 144 hours at 125°C. Capacitance was recorded at 24 hour intervals and results were plotted in Figures 7 through 12.

The average capacitance of the various lots aged exhibited small changes. A determination of the effectiveness of the Heat Aging

TABLE VII

EFFECT OF HEAT TREATMENT ON ELECTRICAL PERFORMANCE

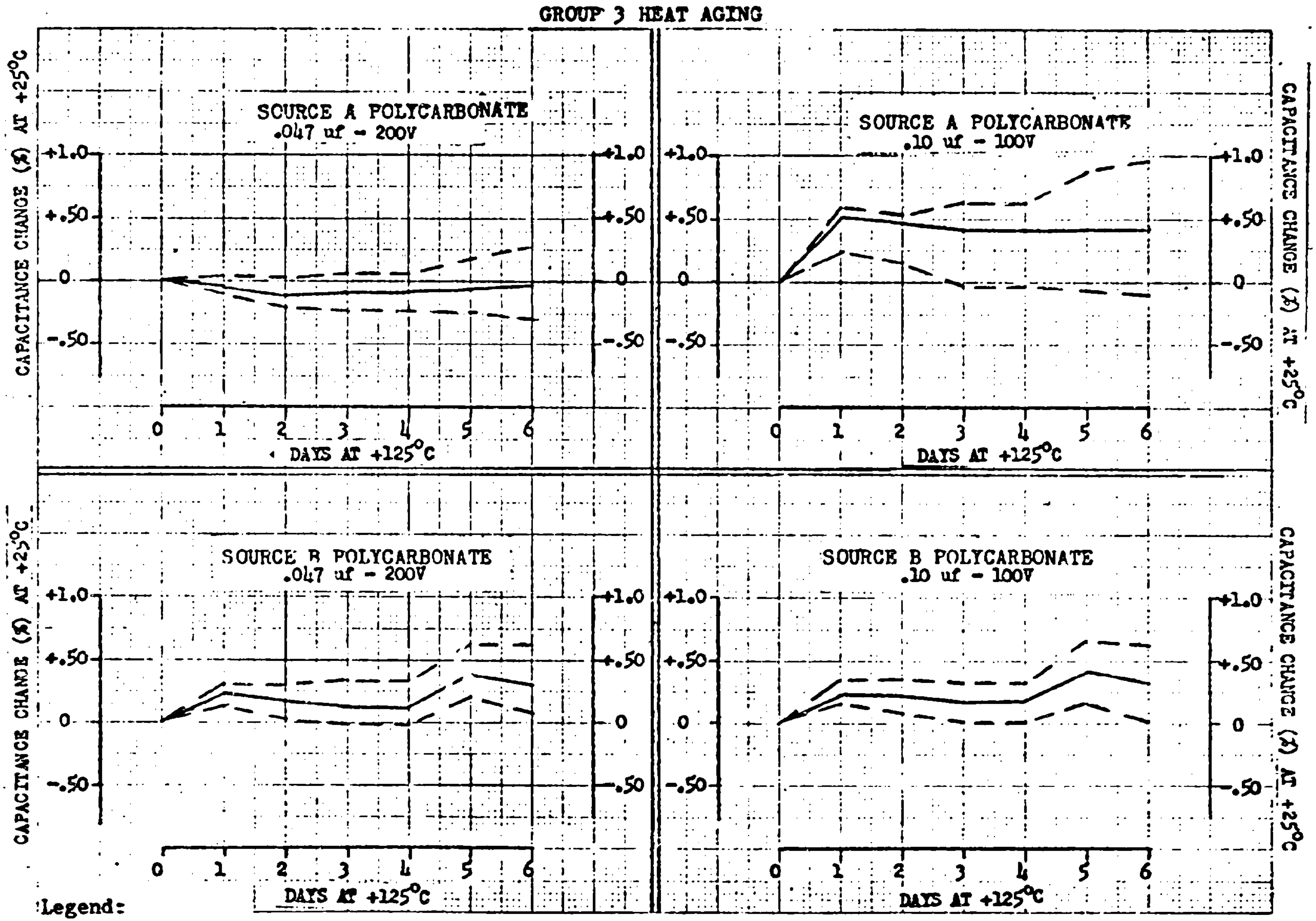
MATERIAL: METALLIZED POLYCARBONATE
SUPPLIER: DOMESTIC SOURCE A

Heat Treatment	Section Rating	No. Units Tested	No. Insulation Resistance Rejects
Group 3	0.047 mfd - 200V	32	0
	0.10 mfd - 100V	32	4
	1.0 mfd - 200V	32	8
	4.0 mfd - 100V	32	21
Group 4	0.047 mfd - 200V	32	0
	0.10 mfd - 100V	32	3
	1.0 mfd - 200V	32	3
	4.0 mfd - 100V	32	20
Group 5	0.047 mfd - 200V	32	0
	0.10 mfd - 100V	32	10
	1.0 mfd - 200V	32	8
	4.0 mfd - 100V	32	16

HEAT AGING

OF

METALLIZED POLYCARBONATE CAPACITORS



Legend:
Average: ———
Extremes: — — —

Figure 7

HEAT AGING

OF

METALLIZED POLYCARBONATE CAPACITORS

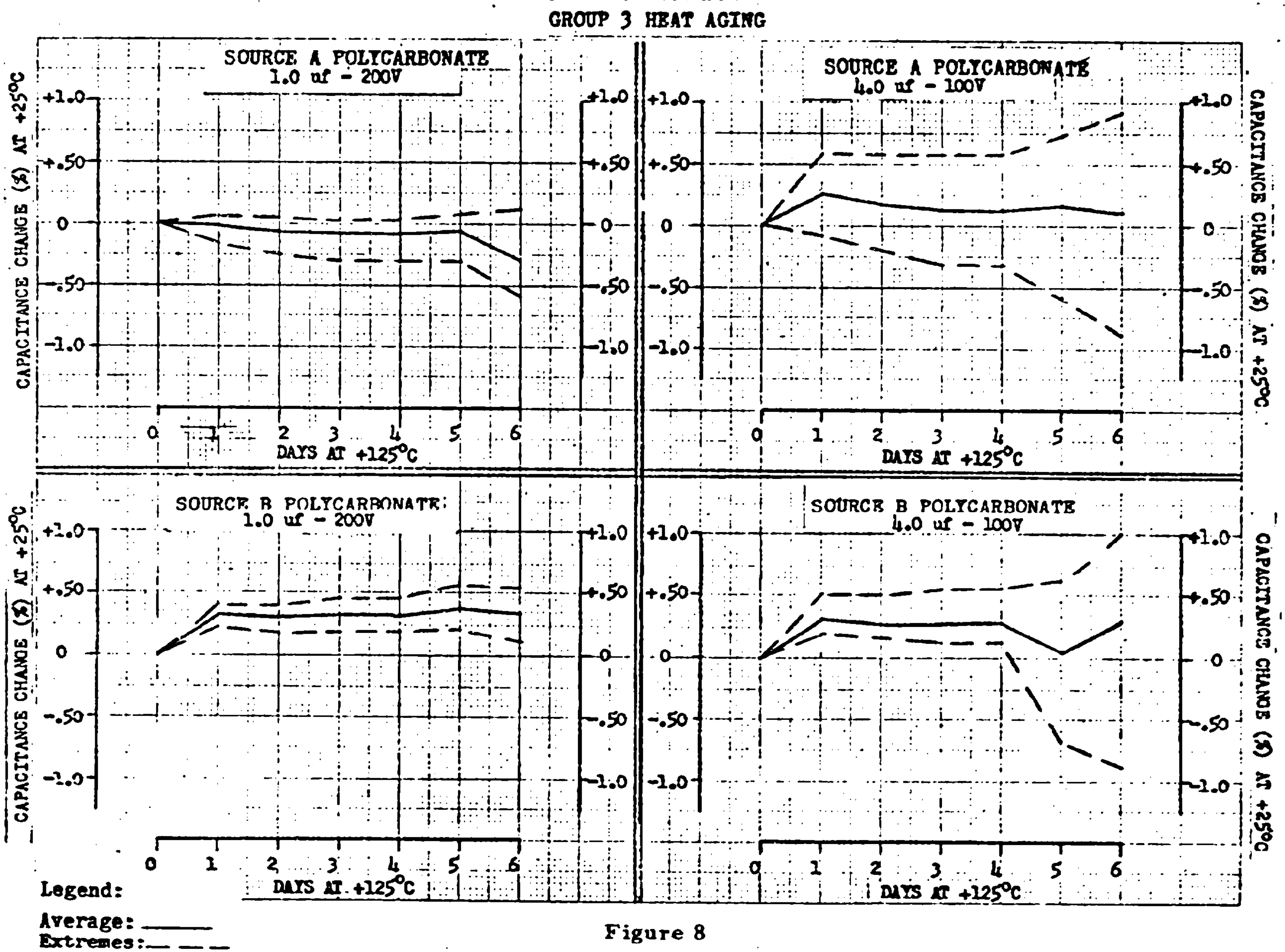


Figure 8

HEAT AGING

OF

METALLIZED POLYCARBONATE CAPACITORS

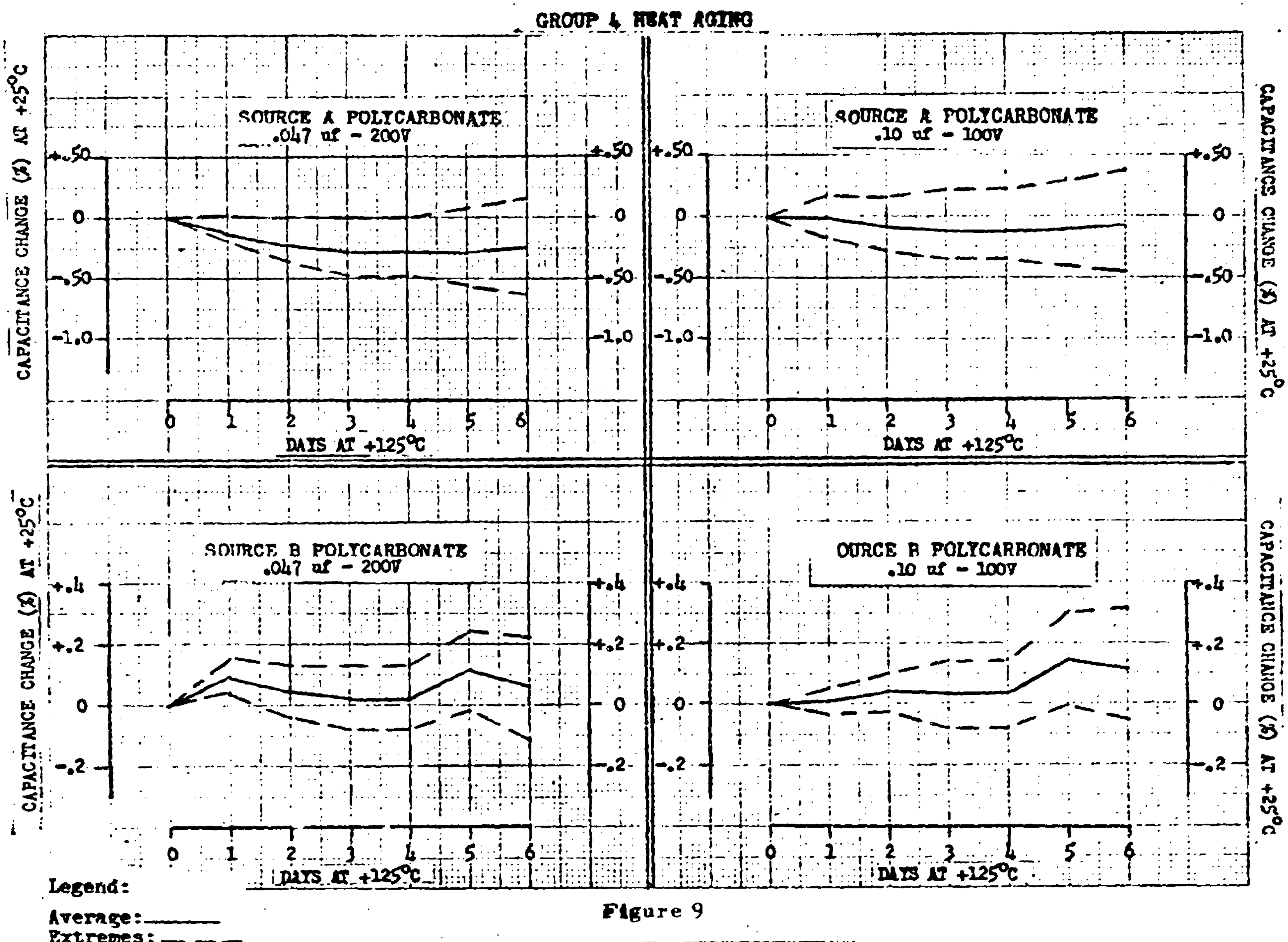


Figure 9

HEAT AGING

OF

METALLIZED POLYCARBONATE CAPACITORS

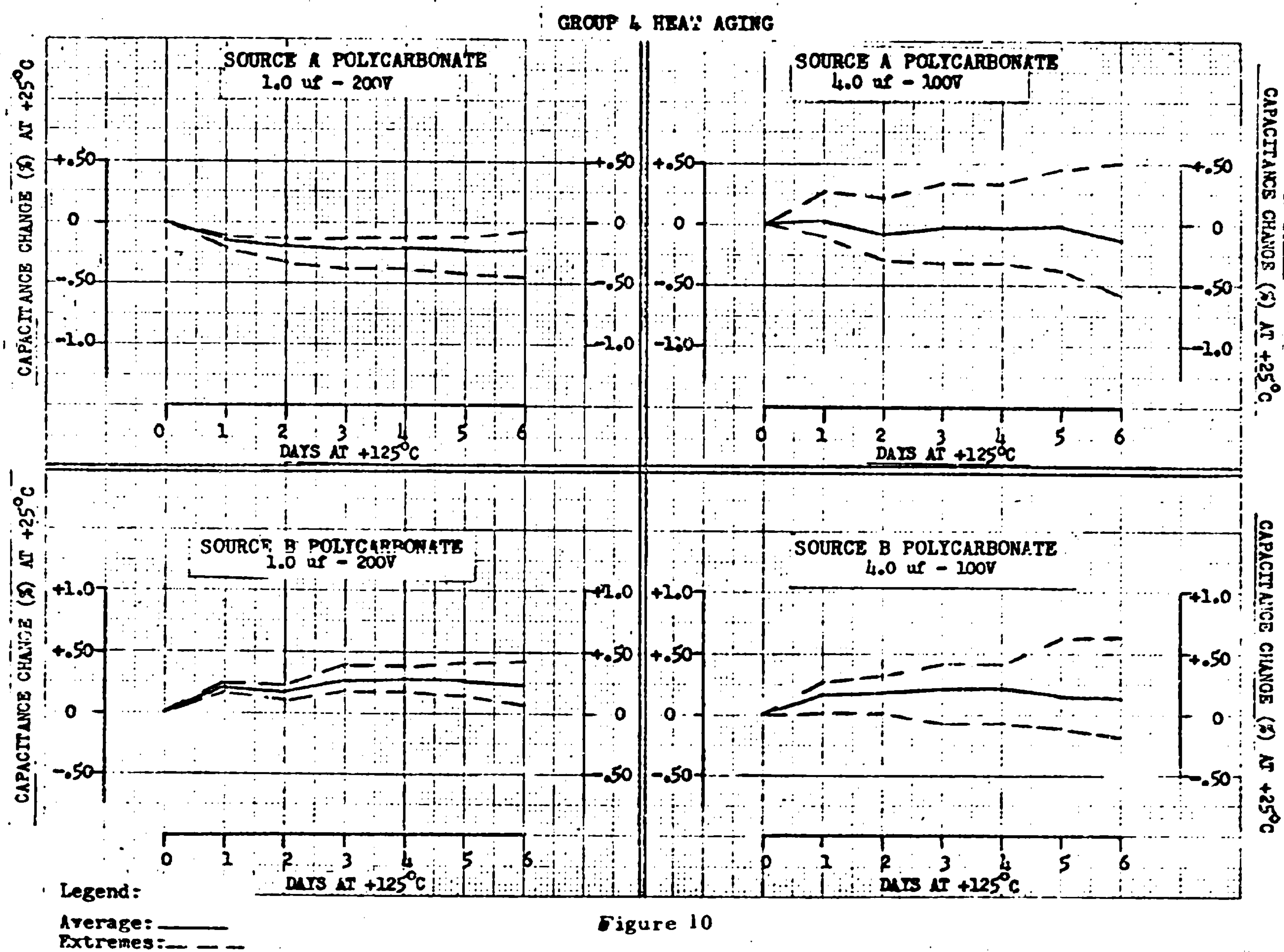


Figure 10

HEAT AGING

OF

METALLIZED POLYCARBONATE CAPACITORS

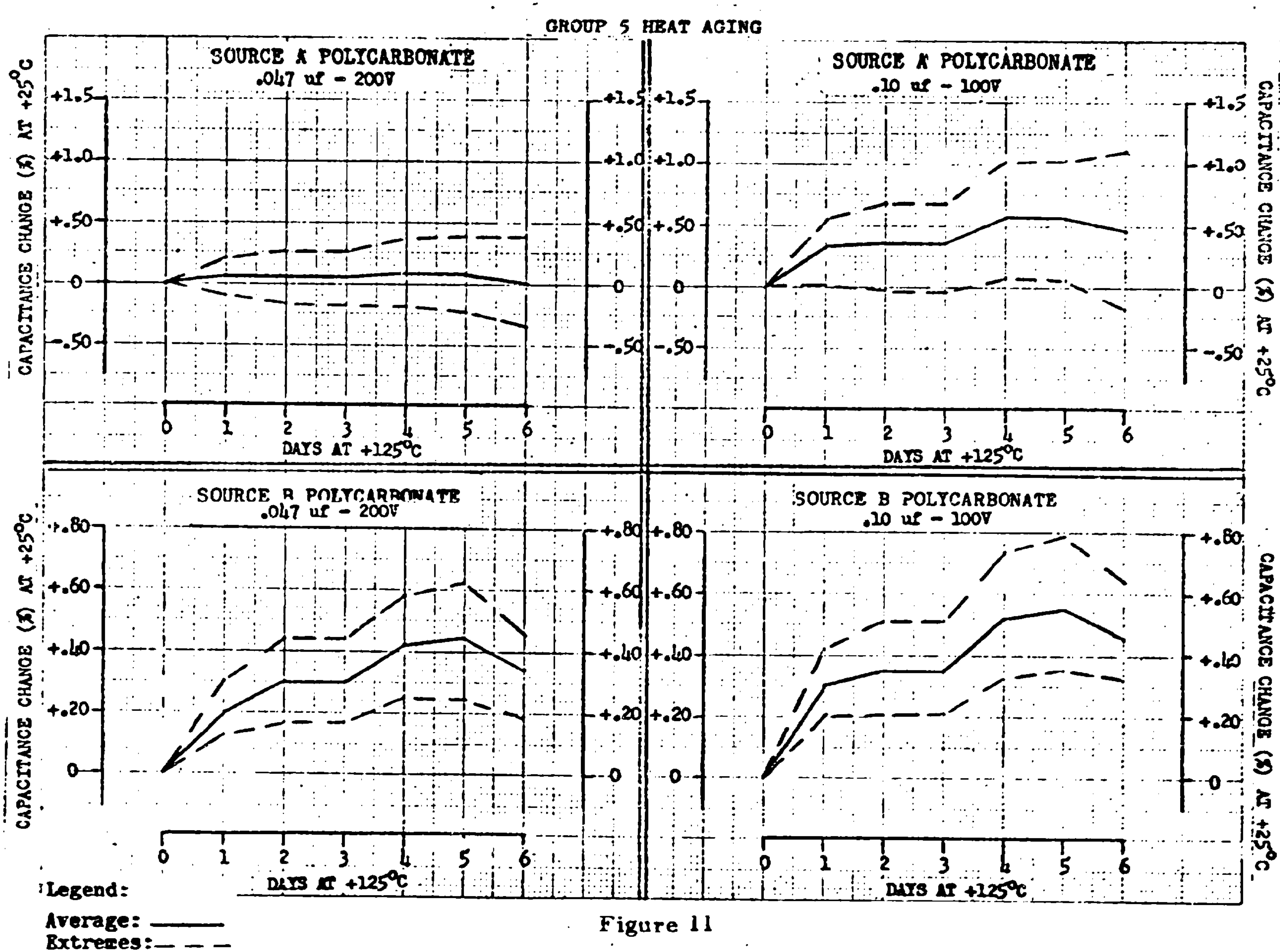
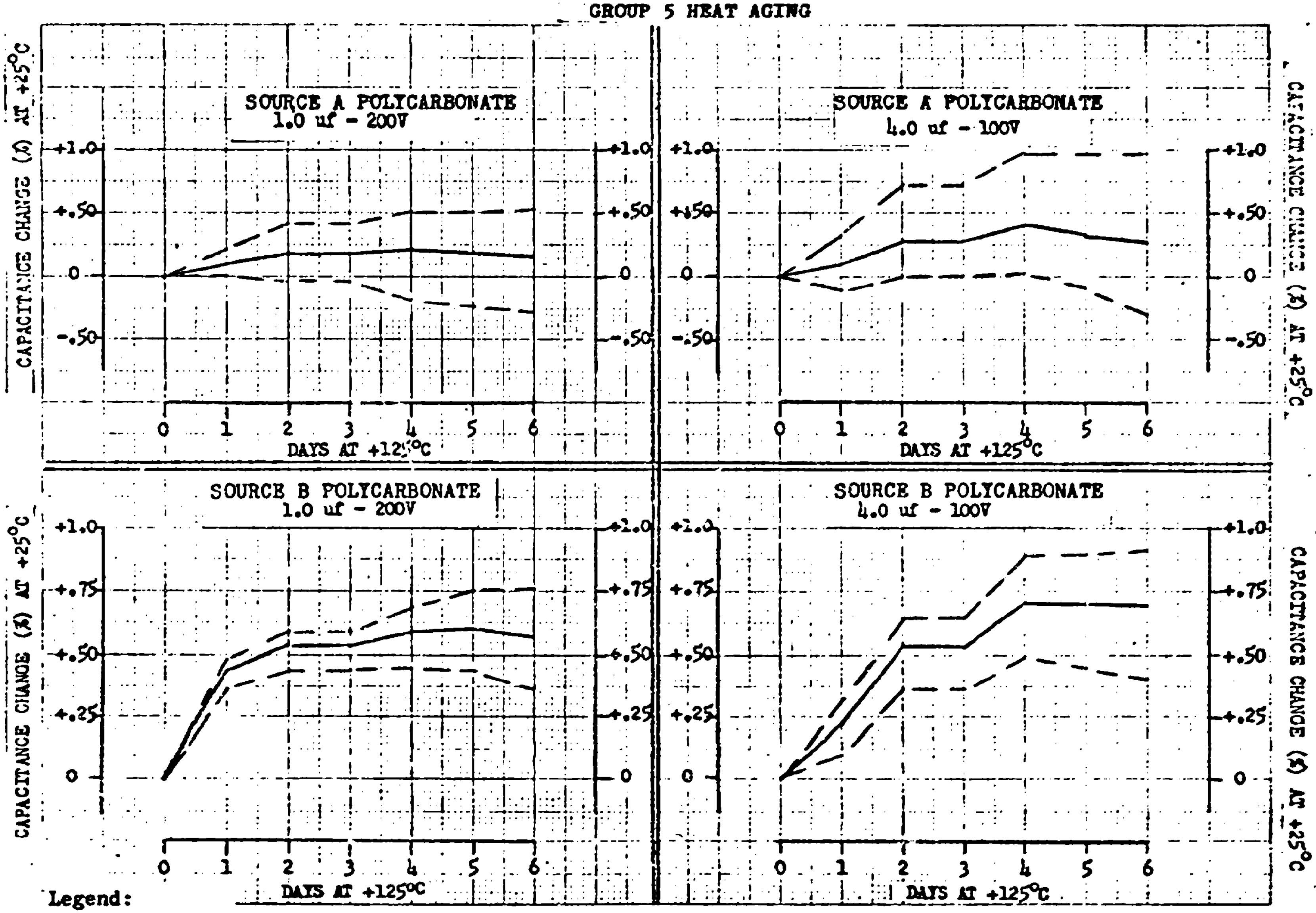


Figure 11

HEAT AGING

OF

METALLIZED POLYCARBONATE CAPACITORS



Legend:

Average: ———

Extremes: — — —

Figure 12

could not be made at this time but was made at the conclusion of the Phase 1 electrical testing.

The capacitor sections that did not receive the Heat Aging were identified as Subgroup A and those that were aged were identified as Subgroup B.

3.3.7 Assembly

All of the capacitor sections that had received the heat treatment and subsequent electrical section test were completely assembled.

Polycarbonate film is quite susceptable to contamination from a wide variety of materials including the natural excretions from the skin. Precautions were taken during all of the steps comprising the assembly operation to assure that the metallized polycarbonate sections were not subjected to contamination from external sources.

Metal solder was applied to the electrode ends of the capacitor section after which lead wires were attached. The next step in the assembly operation consisted of applying plastic insulating end caps to each end of the capacitor section. The capacitor section was then inserted into an electro-tinned brass tube. A compression glass header was threaded over the lead wire at each end of the capacitor section and was soldered to the case. The eyelet of one of the two

compression glass headers was solder sealed. The next step in the operation consisted of filling the voids inside the assembly with a potting resin through the single remaining open eyelet. The function of this potting resin was to provide shock and vibration resistance consistent with the requirements of MIL-C-39022. The one remaining open eyelet was solder sealed thus completing the operation. The entire lot of capacitors was given a 100% visual inspection and a seal test.

3.3.8 Production Burn-In

It is common practice for the manufacturer of high quality components to subject established reliability parts to a production burn-in, or voltage conditioning, and to incorporate this screening procedure as an integral portion of his process. It was especially important to the success of this Production Engineering Measure to include an effective burn-in to insure attainment of the failure rate objective.

The test capacitors were first subjected to pre burn-in dielectric strength test and electrical measurements. The dielectric breakdown rejects were removed and the remainder of the capacitors were split into two equal groups. One group was given a burn-in consisting of the application of rated voltage for 250 hours at 125°C. The second group was subjected to 140% of rated voltage for 250 hours at 125°C.

The criteria used to determine a failure were the requirements of MIL-C-39022 and SCS-301 Amendment 1 as follows:

Dielectric Strength:	2x rated voltage
Capacitance Tolerance:	±10%
Dissipation Factor:	0.30% maximum
Insulation Resistance:	25°C, 10^5 megohms x mfds or 5×10^5 megohms minimum
	125°C, 10^3 megohms x mfds or 2×10^3 megohms minimum.

The results of the pre and post burn-in electrical measurements are broken down in Table VIII into both Heat Treatment and Material Source categories. These results are dramatic evidence of the inadequacy of the domestic Source A material whereas both Source B and Source C gave indications of being of sufficient quality to achieve the contract objective. The performance of the Source C capacitors was so consistent that a choice of Heat Treatment was not yet possible. Table IX presents the 125°C insulation resistance after burn-in.

Table X presents the Source A and Source B capacitor burn-in test results as a function of Heat Aging. It was concluded that the extended heat conditioning produced no discernable effects on capacitor performance and should not be made a part of the manufacturing process.

TABLE VIII

PHASE 1
BURN-IN ELECTRICAL RESULTS

Heat Treatment	Material Source	No. Units Tested	Pre Burn-In Failures	Burn-In Failures	Post Burn-In Failures	125°C IR Failures	Yield %
1	A	Not Tested -					
	B	32	0	0	0	0	100
	C	64	0	0	3	0	95
2	A	Not Tested -					
	B	32	0	0	0	0	100
	C	64	0	0	4	1	94
3	A	128	4	2	75	23	19
	B	64	0	0	1	1	97
	C	64	1	0	2	2	92
4	A	128	7	4	67	23	21
	B	64	0	0	0	5	92
	C	64	0	0	6	1	89
5	A	128	4	3	69	29	18
	B	64	0	0	1	1	94
	C	64	0	0	1	0	98

TABLE IX

PHASE 1
125°C INSULATION RESISTANCE AFTER BURN-IN

Rating	Material Source A	Material Source B	Material Source C
0.047 mfd - 200 V	12 Failures	0 Failures	0 Failures
0.10 mfd - 100 V	12 Failures	0 Failures	1 Failure
1.0 mfd - 200 V	17 Failures	7 Failures	3 Failures
4.0 mfd - 100 V	32 Failures	1 Failure	0 Failures

TABLE X

PHASE 1
EFFECT OF HEAT AGING ON BURN-IN OF METALLIZED POLYCARBONATE CAPACITORS

Sub Group A: No Heat Aged
Sub Group B: Heat Aged

Failure Mode*	Sub Group A Source A	Sub Group A Source B	Sub Group B Source A	Sub Group B Source B
Dielectric Strength	39 Failures	0 Failures	45 Failures	0 Failures
Capacitance Tolerance	33 Failures	1 Failure	28 Failures	2 Failures
Insulation Resistance				
25°C	45 Failures	2 Failures	39 Failures	3 Failures
125°C	42 Failures	6 Failures	33 Failures	4 Failures
Total Failures	159	9	145	9

*After 250 hour production burn-in at 125°C and at rated or accelerated voltage levels.

3.4 Phase 2 - Test and Evaluation of Process Improvements

3.4.1 Group A and B Inspection

All capacitors, including all non-catastrophic rejects, were subjected to Group A inspection in conformance with MIL-C-39022 as modified by SCS-301 Amendment 1. The capacitors were grouped together by capacitance rating and material source to simplify testing and reporting. At the conclusion of the Group A testing, all rejects were removed from the evaluation lots and the lots were put through the Group B Tests. Tables XI, XII, XIII and XIV list in detail the results of the quality conformance inspection. Table XII is the Source B control for the Source A parts listed in Table XI. Table XIV is the Source B control for the Source C parts listed in Table XIII.

A summary of the inspection tests are presented in Table XV as a function of Heat Treatment and Material Source. The following conclusions were drawn:

> Due to the catastrophic failures, poor quality and low yield with Source A material the attainment of the .001% 1000 hour failure rate was not realistic or economically feasible using Source A material.
>
> Since there were no catastrophic failures and most of the parametric failures occurred before Group B testing, the use of Source C material afforded an excellent opportunity for achieving the contract reliability objective.

TABLE XI

EVALUATION TESTING OF SOURCE A DOMESTIC
METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 1200-8-1018R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS 301C473K
Applicable Specification MIL-C-39022 as modified by SCS-301 Amendment 2

Lot Identification Groups 3, 4, & 5
Lot Size 93
Material Source A

Summarized results of quality conformance inspection (Subgroups A and B)

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group A, Subgroup I 100 percent inspection				Sample size 93 Acceptance Number N/A		
Temperature cycling	3.5	4.6.2	5 cycles	93	0	
Seal	3.6	4.6.3	No leakage	93	0	
Dielectric withstanding voltage	3.7	4.6.4	400 VDC	93	0	
Insulation resistance 25°C	3.10	4.6.7	500,000 megohms min.	93	18	
Capacitance	3.8	4.6.5	±.0517 uf ±.0423 uf	93	0	
Dissipation factor	3.9	4.6.6	±.3%	93	0	
Group A, Subgroup 2 Inspection level	AQL = 1.0%			Sample size 13 Acceptance Number 0		
Visual and mechanical Examination (external)	3.3	4.6.1				
Physical dimensions	3.4	4.6.1		13	0	
Marking	3.23	4.6.1		13	0	
Workmanship	3.24	4.6.1		13	0	

TABLE XI

EVALUATION TESTING OF SOURCE A DOMESTIC
METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 1200-8-10203-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301B104K
Applicable Specification MIL-C-39022 as modified by SCS-301 Amendment 2

Lot Identification Groups 3, 4, & 5
Lot Size 92
Material Source A

Summarized results of quality conformance inspection (Subgroups A and B)

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group A, Subgroup I 100 percent inspection				Sample size 92 Acceptance Number N/A		
Temperature cycling	3.5	4.6.2	5 cycles	92	0	
Seal	3.6	4.6.3	No leakage	92	0	
Dielectric withstanding voltage	3.7	4.6.4	200 VDC	92	5	
Insulation resistance 25°C	3.10	4.6.7	500,000 megohms,min.	87	22	
Capacitance	3.8	4.6.5	≤.110 uf ≥.090 uf	87	4	
Dissipation factor	3.9	4.6.6	≤.3%	87	0	
Group A, Subgroup 2 Inspection level	AQL = 1.0%			Sample size 13 Acceptance Number 0		
Visual and mechanical Examination (external)	3.3	4.6.1				
Physical dimensions	3.4	4.6.1		13	0	
Marking	3.23	4.6.1		13	0	
Workmanship	3.24	4.6.1		13	0	

TABLE XI

EVALUATION TESTING OF SOURCE A DOMESTIC
METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 1200-A-1022R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301C105K
Applicable Specification Mil-C-39022 as modified by SCS-301 Amendment 2

Lot Identification Groups 3, 4, & 5
Lot Size 84
Material Source A

Summarized results of quality conformance inspection (Subgroups A and B)

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group A, Subgroup I 100 percent inspection				Sample size 84 Acceptance Number N/A		
Temperature cycling	3.5	4.6.2	5 cycles	84	0	
Seal	3.6	4.6.3	No leakage	84	0	
Dielectric withstanding voltage	3.7	4.6.4	400 VDC	84	44	
Insulation resistance 25°C	3.10	4.6.7	100,000 megohms min.	40	18	
Capacitance	3.8	4.6.5	1.10 uf .90 uf	40	0	
Dissipation factor	3.9	4.6.6	.3%	40	0	
Group A, Subgroup 2 Inspection level	AQL = 1.0%			Sample size 13 Acceptance Number 0		
Visual and mechanical Examination (external)	3.3	4.6.1				
Physical dimensions	3.4	4.6.1		13	0	
Marking	3.23	4.6.1		13	0	
Workmanship	3.24	4.6.1		13	0	

TABLE XI

EVALUATION TESTING OF SOURCE A DOMESTIC
METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 1200-8-1024R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301B405K
Applicable Specification Mil-C-39022 as modified by SCS-301
Amendment 2

Lot Identification Groups 3, 4, & 5
Lot Size 90
Material Source A

Summarized results of quality conformance inspection (Subgroups A and B)

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group A, Subgroup I 100 percent inspection				Sample size 90 Acceptance Number N/A		
Temperature cycling	3.5	4.6.2	5 cycles	90	0	
Seal	3.6	4.6.3	No leakage	90	0	
Dielectric withstanding voltage	3.7	4.6.4	200 VDC	90	20	
Insulation resistance 25°C	3.10	4.6.7	25,000 megohms min	70	26	
Capacitance	3.8	4.6.5	4.40 uf 3.60 uf	70	27	
Dissipation factor	3.9	4.6.6	.3%	70	0	
Group A, Subgroup 2 Inspection level	AQL = 1.0%			Sample size 13 Acceptance Number 0		
Visual and mechanical Examination (external)	3.3	4.6.1				
Physical dimensions	3.4	4.6.1		13	0	
Marking	3.23	4.6.1		13	0	
Workmanship	3.24	4.6.1		13	0	

TABLE XI

EVALUATION TESTING OF SOURCE A DOMESTIC
METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 1200-9-29R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301C473K
Applicable Specification Mil-C-39022 as modified by SCS-301 Amendment 2

Lot Identification Groups 3, 4, & 5
Lot Size 76
Material Source A

Summarized results of quality conformance inspection (Subgroups A and B)

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group B: Sample Size 76; Acceptance Number N/A						
Insulation resistance (at high ambient)	3.10	4.6.7	2,000 Megohms Min.	76	12	Continued Test
Flashover	3.11	4.6.8	250 VDC	76	0	
Life at +125° C Volts 280 VDC	3.21	4.6.18	250 Hours	76	0	
Insulation resistance at 25°C after high temperature life test	3.21	4.6.7	167,000 Megohms, Min.	76	3	
Capacitance after high temperature life test	3.21	4.6.5	±10% of Initial Value	76	0	
Dissipation factor after high temperature life test	3.21	At +125°C, 24 - 48 hrs. 202 - 250 hrs. at +25°C	 .6% .6% .33%	 76 76 76	 0 0 0	

TABLE XI

EVALUATION TESTING OF SOURCE A DOMESTIC
METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 1200-9-211R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301B104K
Applicable Specification Mil-C-39022 as modified by SCS-301 Amendment 2

Lot Identification Groups 3, 4, & 5
Lot Size 64
Material Source A

Summarized results of quality conformance inspection (Subgroups A and B)

Group B: Sample Size 64; Acceptance Number N/A

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Insulation resistance (at high ambient)	3.10	4.6.7	2,000 Megohms Min.	64	12	Continued Test
Flashover	3.11	4.6.8	125 VDC	64	0	
Life at +125° C, Volts 140 VDC	3.21	4.6.18	250 Hours	64	1	
Insulation resistance at 25°C after high temperature life test	3.21	4.6.7	167,000 Megohms Min.	63	2	
Capacitance after high temperature life test	3.21	4.6.5	±10% of Initial Value	63	0	
Dissipation factor after high temperature life test	3.21	At +125°C, 24 - 48 hrs	.6%	63	0	
		202 - 250 hrs	.6%	63	0	
		at +25°C	.33%	63	0	

TABLE XI

EVALUATION TESTING OF SOURCE A DOMESTIC METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 1200-9-213R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301C105K
Applicable Specification Mil-C-39022 as modified by SCS-301 Amendment 2

Lot Identification Groups 3, 4, & 5
Lot Size 22
Material Source A

Summarized results of quality conformance inspection (Subgroups A and B)

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group B:			Sample Size 22; Acceptance Number N/A			
Insulation resistance (at high ambient)	3.10	4.6.7	2,000 Megohms Min.	22	17	Continued Test
Flashover	3.11	4.6.8	250 VDC	22	0	
Life at +125° C Volts 280 VDC	3.21	4.6.8	250 Hours	22	0	
Insulation resistance at 25°C after high temperature life test	3.21	4.6.7	33,300 Megohms Min	22	1	
Capacitance after high temperature life test	3.21	4.6.5	±10% of Initial Value	22	0	
Dissipation factor after high temperature life test	3.21	At +125°C, 24 - 48 hrs 202 - 250 hrs at +25°C	.6% .6% .33%	22 22 22	0 0 0	

TABLE XI

EVALUATION TESTING OF SOURCE A DOMESTIC
METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 1200-9-215R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301B405K
Applicable Specification Mil-C-39022 as modified by SCS-301

Lot Identification Groups 3, 4, & 5
Lot Size 41
Material Source A

Summarized results of quality conformance inspection (Subgroups A and B)

Group B:

Sample Size 41
Acceptance Number N/A

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Insulation resistance (at high ambient)	3.10	4.6.7	250 Megohms Min.	41	32	Continued Test
Flashover	3.11	4.6.8	125 VDC	41	0	
Life at +125° C Volts 140 VDC	3.21	4.6.18	250 Hours	43	3	
Insulation resistance at 25°C after high temperature life test	3.21	4.6.7	8,350 Megohms Min.	40	4	
Capacitance after high temperature life test	3.21	4.6.5	±10% of Initial Value	40	4	
Dissipation factor after high temperature life test	3.21	At +125°C 24 - 48 hrs. 202 - 250 hrs. at +25°C	.6% .6% .33%	40 40 40	0 0 0	

TABLE XII

EVALUATION TESTING OF SOURCE B FOREIGN
METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 1200-9-1109R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301C473K
Applicable Specification Mil-C-39022 as modified by SCS-301
Amendment 2

Lot Identification Groups 1 and 2
Lot Size 16
Material Source B

Summarized results of quality conformance inspection

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group A, Subgroup I 100 percent inspection				Sample size 16 Acceptance Number N/A		
Temperature cycling	3.5	4.6.2	5 cycles	16	0	
Seal	3.6	4.6.3	No leakage	16	0	
Dielectric withstanding voltage	3.7	4.6.4	400 VDC	[illegible]	0	
Insulation resistance 25°C	3.10	4.6.7	500,000 Megohms Min	[illegible]	0	
Capacitance	3.8	4.6.5	.0517 uf .0423 uf	16	0	
Dissipation factor	3.9	4.6.6	.3 %	16	0	
Group A, Subgroup 2 Inspection level	AQL = 1.0%			Sample size 13 Acceptance Number 0		
Visual and mechanical Examination (external)	3.3	4.6.1				
Physical dimensions	3.4	4.6.1		13	0	
Marking	3.23	4.6.1		13	0	
Workmanship	3.24	4.6.1		13	0	

TABLE XII

EVALUATION TESTING OF SOURCE B FOREIGN METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 1200-9-1111R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301B104K
Applicable Specification Mil-C-39022 as modified by SCS-301 Amendment 2

Lot Identification Groups 1 and 2
Lot Size 16
Material Source B

Summarized results of quality conformance inspection

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group A, Subgroup I 100 percent inspection				Sample size 16 Acceptance Number N/A		
Temperature cycling	3.5	4.6.2	5 cycles	16	0	
Seal	3.6	4.6.3	No leakage	16	0	
Dielectric withstanding voltage	3.7	4.6.4	200 VDC	16	0	
Insulation resistance 25°C	3.10	4.6.7	500,000 Megohms Min	16	0	
Capacitance	3.8	4.6.5	= .110 uf = .090 uf	16	0	
Dissipation factor	3.9	4.6.6	= .3%	16	0	
Group A, Subgroup 2 Inspection level	AQL = 1.0%			Sample size 13 Acceptance Number 0		
Visual and mechanical Examination (external)	3.3	4.6.1				
Physical dimensions	3.4	4.6.1		13	0	
Marking	3.23	4.6.1		13	0	
Workmanship	3.24	4.6.1		13	0	

TABLE XII

EVALUATION TESTING OF SOURCE B FOREIGN
METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 1200-9-1113R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301C105K
Applicable Specification Mil-C-39022 as modified by SCS-301 Amendment 2

Lot Identification Groups 1 and 2
Lot Size 16
Material Source B

Summarized results of quality conformance inspection

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group A, Subgroup I 100 percent inspection				Sample size 15 Acceptance Number N/A		
Temperature cycling	3.5	4.6.2	5 cycles	16	0	
Seal	3.6	4.6.3	No leakage	16	0	
Dielectric withstanding voltage	3.7	4.6.4	400 VDC	16	0	
Insulation resistance 25°C	3.10	4.6.7	100,000 Megohms Min	16	0	
Capacitance	3.8	4.6.5	±1.10 uF .90 uF	16	0	
Dissipation factor	3.9	4.6.6	≤ .3%	16	0	
Group A, Subgroup 2 Inspection level	AQL = 1.0%			Sample size 13 Acceptance Number 0		
Visual and mechanical Examination (external)	3.3	4.6.1				
Physical dimensions	3.4	4.6.1		13	0	
Marking	3.23	4.6.1		13	0	
Workmanship	3.24	4.6.1		13	0	

TABLE XII

EVALUATION TESTING OF SOURCE B FOREIGN
METALLIZED POLYCARBONATE GROUP A AND B TEST

Page 4 of 8

Report No. 1200-9-1115R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301F405K
Applicable Specification Mil-C-39022 Amendment 2 as modified by SCS-301

Lot Identification Groups 1 and 2
Lot Size 16
Material Source B

Summarized results of quality conformance inspection

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group A, Subgroup I 100 percent inspection				Sample size 16 Acceptance Number N/A		
Temperature cycling	3.5	4.6.2	5 cycles	16	0	
Seal	3.6	4.6.3	No leakage	16	0	
Dielectric withstanding voltage	3.7	4.6.4	200 VDC	16	0	
Insulation resistance 25°C	3.10	4.6.7	25,000 Megohms Min	16	0	
Capacitance	3.8	4.6.5	4.40 uf 3.60 uf	16	0	
Dissipation factor	3.9	4.6.6	≤ .3%	16	0	
Group A, Subgroup 2 Inspection level	AQL = 1.0%			Sample size 13 Acceptance Number 0		
Visual and mechanical Examination (external)	3.3	4.6.1				
Physical dimensions	3.4	4.6.1		13	0	
Marking	3.23	4.6.1		13	0	
Workmanship	3.24	4.6.1		13	0	

TABLE XII

EVALUATION TESTING OF SOURCE B FOREIGN
METALLIZED POLYCARBONATE GROUP A AND B TEST

Page 5 of 8

Report No. 91-9-325B-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301C473K
Applicable Specification MIL-C-39022 as modified by SCS-301
Amendment 2

Lot Identification Groups 1 and 2
Lot Size 16
Material Source B

Summarized results of quality conformance inspection

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group B:				Sample Size 16 Acceptance Number N/A		
Insulation resistance (at high ambient)	3.10	4.6.7	2,000 Megohms Min	16	0	Continued Test
Flashover	3.11	4.6.8	250 VDC	16	0	
Life at +125° C Volts 280 VDC	3.21	4.6.18	250 hours	16	0	
Insulation resistance at 25°C after high temperature life test	3.21	4.6.7	167,000 Megohms Min	16	0	
Capacitance after high temperature life test	3.21	4.6.5	±10% of Initial Value	16	0	
Dissipation factor after high temperature life test	3.21	At +125°C 24 - 48 hrs 202 - 250 hrs at +25°C	 .6% Max .6% Max .33% Max	 16 16 16	 0 0 0	

TABLE XII

EVALUATION TESTING OF SOURCE B FOREIGN
METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 91-9-325R-000
Contract No. DAAP05-67-C-2707
Customer Part Number SCS-301B104K
Applicable Specification Mil-C-39022 Amendment 2 as modified by SCS-301

Lot Identification Group 1 and 2
Lot Size 16
Material Source B

Summarized results of quality conformance inspection

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group B:				Sample Size 16	Acceptance Number N/A	
Insulation resistance (at high ambient)	3.10	4.6.7	2,000 Megohms Min	16	0	Continued Test
Flashover	3.11	4.6.8	125 VDC	16	0	
Life at +125° C Volts 140 VDC	3.21	4.6.18	250 hours	16	0	
Insulation resistance at 25°C after high temperature life test	3.21	4.6.7	167,000 Megohms Min	16	0	
Capacitance after high temperature life test	3.21	4.6.5	±10% of Initial Value	16	0	
Dissipation factor after high temperature life test	3.21	At +125°C 24 - 48 hrs. 202 - 250 hrs At +25°C	 .6% Max. .6% Max. .33% Max.	16 16 16	0 0 0	

TABLE XII

EVALUATION TESTING OF SOURCE B FOREIGN
METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 91-9-325R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301C105K
Applicable Specification Mil-C-39022 Amendment 2 as modified by SCS-301

Lot Identification Group 1 and 2
Lot Size 16
Material Source B

Summarized results of quality conformance inspection

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group B:				Sample Size 16; Acceptance Number N/A		
Insulation resistance (at high ambient)	3.10	4.6.7	1,000 Megohms Min.	16	7	Continued Test
Flashover	3.11	4.6.8	250 VDC	16	0	
Life at +125° C Volts 280 VDC	3.21	4.6.18	250 hours	16	0	
Insulation resistance at 25°C after high temperature life test	3.21	4.6.7	33,300 Megohms Min.	16	0	
Capacitance after high temperature life test	3.21	4.6.5	±10% of Initial Value	16	0	
Dissipation factor after high temperature life test	3.21	At +125°C 24 - 48 hrs 202 - 250 hrs At +25°C	 .6% Max .6% Max .33% Max	 16 16 16	 0 0 0	

TABLE XII

EVALUATION TESTING OF SOURCE B FOREIGN
METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 91-9-325R-000
Contract No. DAAP05-67-C-2707
Customer Part Number SCS-301P405K
Applicable Specification Mil-C-39022 as modified by SCS-301 Amendment 2

Lot Identification Group 1 and 2
Lot Size 16
Material Source B

Summarized results of quality conformance inspection

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group B: Sample Size 16; Acceptance Number N/A						
Insulation resistance (at high ambient)	3.10	4.6.7	250 Megohms Min	16	1	C
Flashover	3.11	4.6.8	125 VDC	16	0	
Life at +125° C Volts 140 VDC	3.21	4.6.18	250 hours	16	0	
Insulation resistance at 25°C after high temperature life test	3.21	4.6.7	8,350 Megohms Min.	16	1	
Capacitance after high temperature life test	3.21	4.6.5	±10% of Initial Value	16	0	
Dissipation factor after high temperature life test	3,21	At +125°C 24-48 hrs 202 - 250 hrs At +25°C	 .6% Max. .6% Max. .33% Max.	 16 16 16	 0 0 0	

TABLE XIII

EVALUATION TESTING OF SOURCE A DOMESTIC
METALLIZED POLYCARBONATE GROUP A AND B TEST

Page 1 of 8

Report No. 1200-9-1108R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301C473K
Applicable Specification Mil-C-39022 as modified by SCS-301
Amendment 2

Lot Identification Groups 1, 2, 3, 4, & 5
Lot Size 80
Material Source C

Summarized results of quality conformance inspection

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group A, Subgroup I 100 percent inspection				Sample size 80 Acceptance Number N/A		
Temperature cycling	3.5	4.6.2	5 cycles	80	0	
Seal	3.6	4.6.3	No leakage	80	0	
Dielectric withstanding voltage	3.7	4.6.4	400 VDC	80	0	
Insulation resistance 25°C	3.10	4.6.7	500,000 Megohms Min.	80	0	
Capacitance	3.8	4.6.5	≤.0517 uf ≥.0423 uf	80	0	
Dissipation factor	3.9	4.6.6	≤.3%	80	0	
Group A, Subgroup 2 Inspection level	AQL = 1.0%			Sample size 13 Acceptance Number 0		
Visual and mechanical Examination (external)	3.3	4.6.1				
Physical dimensions	3.4	4.6.1		13	0	
Marking	3.23	4.6.1		13	0	
Workmanship	3.24	4.6.1		13	0	

TABLE XIII

EVALUATION TESTING OF SOURCE A DOMESTIC
METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 1200-9-1110R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301B104K
Applicable Specification Mil-C-39022 as modified by SCS-301
Amendment 2

Lot Identification Groups 1, 2, 3, 4, & 5
Lot Size 79
Material Source C

Summarized results of quality conformance inspection

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group A, Subgroup I 100 percent inspection.				Sample size 79 Acceptance Number N/A		
Temperature cycling	3.5	4.6.2	5 cycles	79	0	
Seal	3.6	4.6.3	No leakage	79	0	
Dielectric withstanding voltage	3.7	4.6.4	200 VDC	79	0	
Insulation resistance 25°C	3.10	4.6.7	500,000 Megohms Min.	79	0	
Capacitance	3.8	4.7.5	+.110 uf -.090 uf	79	0	
Dissipation factor	3.9	4.6.6	≤.3%	79	0	
Group A, Subgroup 2 Inspection level	AQL = 1.0%			Sample size 13 Acceptance Number 0		
Visual and mechanical Examination (external)	3.3	4.6.1				
Physical dimensions	3.4	4.6.1		13	0	
Marking	3.23	4.6.1		13	0	
Workmanship	3.24	4.6.1		13	0	

TABLE XIII

EVALUATION TESTING OF SOURCE A DOMESTIC
METALLIZED POLYCARBONATE GROUP A AND B TEST

Page 3 of 8

Report No. 1200-9-1112B-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301C105K
Applicable Specification Mil-C-39022 as modified by SCS-301 Amendment 2

Lot Identification Groups 1, 2, 3, 4, & 5
Lot Size 80
Material Source C

Summarized results of quality conformance inspection

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group A, Subgroup I 100 percent inspection				Sample size 80 Acceptance Number N/A		
Temperature cycling	3.5	4.6.2	5 cycles	80	0	
Seal	3.6	4.6.3	No leakage	80	0	
Dielectric withstanding voltage	3.7	4.6.4	400 VDC	80	0	
Insulation resistance 25°C	3.10	4.6.7	100,000 Megohms Min.	80	11	
Capacitance	3.8	4.6.5	1.10 uf .90 uf	80	0	
Dissipation factor	3.9	4.6.6	.3%	80	0	
Group A, Subgroup 2 Inspection level	AQL = 1.0%			Sample size 13 Acceptance Number 0		
Visual and mechanical Examination (external)	3.3	4.6.1				
Physical dimensions	3.4	4.6.1		13	0	
Marking	3.23	4.6.1		13	0	
Workmanship	3.24	4.6.1		13	0	

TABLE XIII

EVALUATION TESTING OF SOURCE A DOMESTIC
METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 1200-9-1114R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301B405K
Applicable Specification Mil-C-39022 as modified by SCS-301
Amendment 2

Lot Identification Groups 1, 2, 3, 4, & 5
Lot Size 80
Material Source C

Summarized results of quality conformance inspection

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group A, Subgroup I 100 percent inspection				Sample size 80 Acceptance Number N/A		
Temperature cycling	3.5	4.6.2	5 cycles	80	0	
Seal	3.6	4.6.3	No leakage	80	0	
Dielectric withstanding voltage	3.7	4.6.4	200 VDC	80	0	
Insulation resistance 25°C	3.10	4.6.7	25,000 Megohms Min.	80	5	
Capacitance	3.8	4.6.5	4.40 uf 3.60 uf	80	0	
Dissipation factor	3.9	4.6.6	.3%	80	0	
Group A, Subgroup 2 Inspection level	AQL = 1.0%			Sample size 13 Acceptance Number 0		
Visual and mechanical Examination (external)	3.3	4.6.1				
Physical dimensions	3.4	4.6.1		13	0	
Marking	3.23	4.6.1		13	0	
Workmanship	3.24	4.6.1		13	0	

TABLE XIII

EVALUATION TESTING OF SOURCE A DOMESTIC
METALLIZED POLYCARBONATE GROUP A AND B TEST

Page 5 of 8

Report No. 91-9-325R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301C473K
Applicable Specification Mil-C-39022 as modified by SCS-301
Amendment 2

Lot Identification Groups 1, 2, 3, 4, &5
Lot Size 80
Material Source C

Summarized results of quality conformance inspection

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group B:			Sample Size 80 Acceptance Number N/A			
Insulation resistance (at high ambient)	3.10	4.6.7	2,000 Megohms Min.	80	0	Continued Test
Flashover	3.11	4.6.8	250 VDC	80	0	
Life at +125° C Volts 280 VDC	3.21	4.6.18	250 hours	80	0	
Insulation resistance at 25°C after high temperature life test	3.21	4.6.7	167,000 Megohms Min.	80	1	
Capacitance after high temperature life test	3.21	4.6.5	±10% of Initial Value	80	0	
Dissipation factor after high temperature life test	3.21	At +125°C 24 - 48 hrs. 202 - 250 hrs. at +25°C	 .6% .6% .33%	 80 80 80	 0 0 0	

TABLE XIII

EVALUATION TESTING OF SOURCE A DOMESTIC
METALLIZED POLYCARBONATE GROUP A AND B TEST

Page 6 of 8

Report No. 91-9-325R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301B104K
Applicable Specification MIL-C-39022 as modified by SCS-301
Amendment 2

Lot Identification Groups 1, 2, 3, 4, &5
Lot Size 79
Material Source C

Summarized results of quality conformance inspection

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group B: Sample Size 79; Acceptance Number N/A						
Insulation resistance (at high ambient)	3.10	4.6.7	2,000 Megohms Min.	79	1	Continued Test
Flashover	3.11	4.6.8	125 VDC	79	0	
Life at +125° C Volts 140 VDC	3.21	4.6.18	250 hours	79	0	
Insulation resistance at 25°C after high temperature life test	3.21	4.6.7	167,000 Megohms Min.	79	8	
Capacitance after high temperature life test	3.21	4.6.5	±10% of Initial Value	79	0	
Dissipation factor after high temperature life test	3.21	At +125°C 24 - 48 hrs 202 - 250 hrs at +25°C	 .6% .6% .33%	 79 79 79	 0 0 0	

TABLE XIII

EVALUATION TESTING OF SOURCE A DOMESTIC
METALLIZED POLYCARBONATE GROUP A AND B TEST

Page 7 of 8

Report No. 91-9-325R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301C105K
Applicable Specification MIL-C-39022 as modified by SCS-301 Amendment 2

Lot Identification Groups 1, 2, 3, 4, &5
Lot Size 69
Material Source C

Summarized results of quality conformance inspection

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group B:				Sample Size 69 Acceptance Number N/A		
Insulation resistance (at high ambient)	3.10	4.6.7	1,000 Megohms Min	69	9	Continued Test
Flashover	3.11	4.6.8	250 VDC	69	0	
Life at +125° C Volts 250 VDC	3.21	4.6.18	250 hours	69	0	
Insulation resistance at 25°C after high temperature life test	3.21	4.6.7	33,300 Megohms Min	69	0	
Capacitance after high temperature life test	3.21	4.6.5	±10% of Initial Value	69	0	
Dissipation factor after high temperature life test	3.21	At +125°C 24 - 48 hrs 202 - 250 hrs at +25°C	 .6% .6% .33%	 69 69 69	 0 0 0	

TABLE XIII

EVALUATION TESTING OF SOURCE A DOMESTIC
METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 91-9-325R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301B405K
Applicable Specification ~~Mil-C-39022 as~~ modified by SCS-301
Amendment 2

Lot Identification Groups 1, 2, 3, 4, &5
Lot Size 75
Material Source C

Summarized results of quality conformance inspection

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group B:				Sample Size 75 Acceptance Number N/A		
Insulation resistance (at high ambient)	3.10	4.6.7	250 Megohms Min.	75	0	Continued Test
Flashover	3.11	4.6.8	125 VDC	75	0	
Life at +125° C Volts 140 VDC	3.21	4.6.18	250 hours	75	0	
Insulation resistance at 25°C after high temperature life test	3.21	4.6.7	8,350 Megohms Min.	75	0	
Capacitance after high temperature life test	3.21	4.6.5	±10% of Initial Value	75	0	
Dissipation factor after high temperature life test	3.21	At +125°C 24 - 48 hrs	.6%	75	0	
		202 - 250 hrs	.6%	75	0	
		At +25°C	.33%	75	0	

TABLE XIV

EVALUATION TESTING OF SOURCE B FOREIGN
METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 1200-8-1019R-000
Contract No. DA...05-67-C-2707
Customer Part Number SCS-301C473K
Applicable Specification MIL-C-39022A as modified by SCS-301 Amendment 2

Lot Identification Groups 3, 4, & 5
Lot Size 48
Material Source B

Summarized results of quality conformance inspection (Subgroups A and B)

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group A, Subgroup I 100 percent inspection				Sample size 48 Acceptance Number N/A		
Temperature cycling	3.5	4.6.2	5 cycles	48	0	
Seal	3.6	4.6.3	No leakage	48	0	
Dielectric withstanding voltage	3.7	4.6.4	400 VDC	48	0	
Insulation resistance 25°C	3.10	4.6.7	=500,000 Megohms Min.	48	0	
Capacitance	3.8	4.6.5	=.0157 uf =.0423 uf	48	0	
Dissipation factor	3.9	4.6.6	=.3%	48	0	
Group A, Subgroup 2 Inspection level	AQL = 1.0%			Sample size 13 Acceptance Number 0		
Visual and mechanical Examination (external)	3.3	4.6.1				
Physical dimensions	3.4	4.6.1		13	0	
Marking	3.23	4.6.1		13	0	
Workmanship	3.24	4.6.1		13	0	

TABLE XIV

EVALUATION TESTING OF SOURCE B FOREIGN METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 1200-8-1021R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301B104K
Applicable Specification MIL-C-39022 Amendment 2 as modified by SCS-301

Lot Identification Groups 3, 4, & 5
Lot Size 48
Material Source B

Summarized results of quality conformance inspection

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group A, Subgroup I 100 percent inspection				Sample size 48 Acceptance Number N/A		
Temperature cycling	3.5	4.6.2	5 cycles	48	0	
Seal	3.6	4.6.3	No leakage	48	0	
Dielectric withstanding voltage	3.7	4.6.4	200 VDC	48	0	
Insulation resistance 25°C	3.10	4.6.7	=500,000 Megohms Min.	48	0	
Capacitance	3.8	4.6.5	=.110 uf =.090 uf	48	0	
Dissipation factor	3.9	4.6.6	=.3%	48	0	
Group A, Subgroup 2 Inspection level	AQL = 1.0%			Sample size 13 Acceptance Number 0		
Visual and mechanical Examination (external)	3.3	4.6.1				
Physical dimensions	3.4	4.6.1		13	0	
Marking	3.23	4.6.1		13	0	
Workmanship	3.24	4.6.1		13	0	

TABLE XIV

EVALUATION TESTING OF SOURCE B FOREIGN
METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 1200-8-1023R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301C1C5K
Applicable Specification Mil-C-39022 as modified by SCS-301
Amendment 2

Lot Identification Groups 3, 4, & 5
Lot Size 48
Material Source B

Summarized results of quality conformance inspection (Subgroups A and B)

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group A, Subgroup I 100 percent inspection				Sample size 48 Acceptance Number N/A		
Temperature cycling	3.5	4.6.2	5 cycles	48	0	
Seal	3.6	4.6.3	No leakage	48	0	
Dielectric withstanding voltage	3.7	4.6.4	400 VDC	48	0	
Insulation resistance 25°C	3.10	4.6.7	= 100,000 Megohms min.	48	0	
Capacitance	3.8	4.6.5	≡ 1.10 uf ≡ .[illegible] uf	48	0	
Dissipation factor	3.9	4.6.6	= .3%	48	0	
Group A, Subgroup 2 Inspection level	AQL = 1.0%			Sample size 13 Acceptance Number 0		
Visual and mechanical Examination (external)	3.3	4.6.1				
Physical dimensions	3.4	4.6.1		13	0	
Marking	3.23	4.6.1		13	0	
Workmanship	3.24	4.6.1		13	0	

TABLE XIV

EVALUATION TESTING OF SOURCE B FOREIGN
METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 1200-8-1025R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301B405K
Applicable Specification MIL-C-39022 as modified by SCS-301
Amendment 2

Lot Identification Groups 3, 4, & 5
Lot Size 48
Material Source B

Summarized results of quality conformance inspection

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group A, Subgroup I 100 percent inspection				Sample size 48 Acceptance Number N/A		
Temperature cycling	3.5	4.6.2	5 cycles	48	0	
Seal	3.6	4.6.3	No leakage	48	0	
Dielectric withstanding voltage	3.7	4.6.4	200 VDC	48	0	
Insulation resistance 25°C	3.10	4.6.7	=25,000 megohms min.	48	2	
Capacitance	3.8	4.6.5	=4.40 uf =3.60 uf	48	0	
Dissipation factor	3.9	4.6.6	=.3%	48	0	
Group A, Subgroup 2 Inspection level	AQL = 1.0%			Sample size 13 Acceptance Number 0		
Visual and mechanical Examination (external)	3.3	4.6.1				
Physical dimensions	3.4	4.6.1		13	0	
Marking	3.4	4.6.1		13	0	
Workmanship	3.4	4.6.1		13	0	

TABLE XIV

EVALUATION TESTING OF SOURCE B FOREIGN
METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 1200-9-210R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301C473K
Applicable Specification Mil-C-39022 as modified by SCS-301
Amendment 2

Lot Identification Groups 3, 4, & 5
Lot Size 48
Material Source B

Summarized results of quality conformance inspection

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group B:				Sample Size 48 Acceptance Number N/A		
Insulation resistance (at high ambient)	3.10	4.6.7	2,000 Megohms Min.	48	0	Continued Test
Flashover	3.11	4.6.8	250 VDC	48	0	
Life at +125° C Volts 280 VDC	3.21	4.6.18	250 hours	48	0	
Insulation resistance at 25°C after high temperature life test	3.21	4.6.7	167,000 Megohms Min.	48	0	
Capacitance after high temperature life test	3.21	4.6.5	± 10% of Initial Value	48	0	
Dissipation factor after high temperature life test	3.21	At +125°C 24 - 48 hrs 202 - 250 hrs at +25°C	 .6% Max. .6% Max. .33% Max.	 48 48 48	 0 0 0	

TABLE XIV

EVALUATION TESTING OF SOURCE B FOREIGN
METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 1200-9-212R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301B104K
Applicable Specification MIL-C-39022 as modified by SCS-301 Amendment 2

Lot Identification Groups 3, 4, & 5
Lot Size 48
Material Source B

Summarized results of quality conformance inspection

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group B:			Sample Size 48 Acceptance Number N/A			
Insulation resistance (at high ambient)	3.10	4.6.7	2,000 Megohms Min.	48	0	Continued Test
Flashover	3.11	4.6.8	125 VDC	48	0	
Life at +125° C Volts 140 VDC	3.21	4.6.18	250 hours	48	0	
Insulation resistance at 25°C after high temperature life test	3.21	4.6.5	167,000 Megohms Min.	48	0	
Capacitance after high temperature life test	3.21	4.6.5	±10% of Initial Value	48	0	
Dissipation factor after high temperature life test	3.21	At +125°C 24 - 48 hrs 202 - 250 hrs at +25°C	 .6% Max. .6% Max. .33% Max.	 48 48 48	 0 0 0	

TABLE [illegible]

EVALUATION TESTING OF SOURCE B FOREIGN METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 1300-9-214B-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301C105K
Applicable Specification Mil-C-39022 as modified by SCS-301 Amendment 2

Lot Identification Groups 3, 4, & 5
Lot Size 47
Material Source B

Summarized results of quality conformance inspection

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group B:				Sample Size 47 Acceptance Number N/A		
Insulation resistance (at high ambient)	3.10	4.6.7	1,000 Megohms Min.	47	5	Continued Test
Flashover	3.11	4.6.7	250 VDC	47	0	
Life at +125° C Volts 280 VDC	3.21	4.6.18	250 hours	47	0	
Insulation resistance at 25°C after high temperature life test	3.21	4.6.7	33,300 Megohms Min.	47	0	
Capacitance after high temperature life test	3.21	4.6.5	±10% of Initial Value	47	0	
Dissipation factor after high temperature life test	3.21	At +125°C 24 - 48 hrs. 202 - 250 hrs. at +25°C	.6% Max. .6% Max .33% Max.	47 47 47	0 0 0	

TABLE XIV

EVALUATION TESTING OF SOURCE B FOREIGN
METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 1200-9-216R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301B405K
Applicable Specification Mil-C-39022 as modified by SCS-301 Amendment 2

Lot Identification Groups 3, 4, & 5
Lot Size 46
Material Source B

Summarized results of quality conformance inspection (Subgroups A and B)

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group B: Sample Size 46; Acceptance Number N/A						
Insulation resistance (at high ambient)	3.10	4.6.7	250 Megohms Min.	46	1	Continued Test
Flashover	3.11	4.6.8	125 VDC	46	0	
Life at +125° C Volts 140 VDC	3.21	4.6.18	250 hours	46	0	
Insulation resistance at 25°C after high temperature life test	3.21	4.6.7	8,350 Megohms Min.	46	0	
Capacitance after high temperature life test	3.21	4.6.5	±10% of Initial Value	46	0	
Dissipation factor after high temperature life test	3.21	At +125°C 24 - 48 hrs 202 - 250 hrs. at +25°C	 .6% Max. .6% Max. .33% Max.	 46 46 46	 0 0 0	

TABLE XV

PHASE 2
SUMMARY OF CONFORMANCE INSPECTION
TEST RESULTS

Heat Treatment	Material Source	No. Units Tested	Group A Failures	125°C IR Failures	Group B Failures	Gross[1] Yield(%)	Group B[2] Yield(%)
1	A	128	Not Tested -				
	B	32	0	0	1	97	97
	C	64	3	0	6	86	90
2	A	128	Not Tested -				
	B	32	0	1	0	97	100
	C	64	4	1	3	88	95
3	A	128	75	23	10	16	33
	B	64	1	1	0	97	100
	C	64	2	2	0	94	100
4	A	128	67	23	5	26	87
	B	64	0	5	0	92	100
	C	64	6	1	0	89	100
5	A	128	69	29	2	22	93
	B	64	1	1	0	97	100
	C	64	1	0	0	98	100

[1]Includes all parametric and catastrophic failures after the production burn-in except burn-in shorts.

[2]Includes only Group B parametric and catastrophic failures.

Because of the unsatisfactory results with Source A material it was decided to drop the 150°C heat treatments (nos. 4 and 5). A choice between the other three heat treatments could not yet be made.

The production burn-in at 140% of rated voltage and 125°C for 250 hours was selected to become an integral portion of the manufacturing process.

3.5 Phase 3 - Reevaluation of Sources and Process Improvements

The Phase 2 test results forcefully demonstrated the total inadequacy of polycarbonate film from Supplier A as a capacitor dielectric and the excellent possibility of attaining the low failure rate objective of the Production Engineering Measure with metallized polycarbonate film from Supplier C.

After careful consideration, however, it was felt that state-of-the-art improvements in film manufacture combined with capacitor manufacturing process modifications could produce a significant improvement in the quality of capacitors utilizing material supplied by domestic Source A. At the same time, verification of the good quality and performance associated with film from domestic Source C could be accomplished. It was decided to reevaluate material from Sources A and C before proceeding with First Article Test Phase of the contract.

3.5.1 Reevaluation of Material Source A

3.5.1.1 Incoming Inspection of New Source A Material

Incoming inspection of polycarbonate material manufactured and metallized by Source A revealed excessive wrinkling and a gauge variation of as much as +22%, -12%. This gauge variation when in the transverse direction had caused some of the rolls to be soft on one edge while hard on the other edge. The material as a whole was considered to be very poor quality.

3.5.1.2 Winding of Capacitor Sections - Source A Material

Winding of 96 sections for another evaluation of Source A material was performed. These sections consisted of the following:

SCS-301C105K 48 pieces 1.0μF 200 V

SCS-301B405K 48 pieces 4.0μF 100 V

3.5.1.3 New Process Evaluation - Source A Material

All 96 capacitor sections were subjected to the new process evaluation listed below as recommended by the manufacture of Source A material.

(a) Heat Treatment #1

Heat treated by raising the temperature under vacuum (250 microns or less) from +25°C to +125°C with a 15.6°C per hour increase for a total of 8 hours.

(b) Voltage Test at 50 VDC and check capacitance and dissipation factor at +25°C.

(c) Assembly

Assemble capacitors with one lead hole open.

(d) Heat Treatment #2

Heat treat by raising the temperature under vacuum (250 microns or less) from +25°C to +125°C with a 15.6°C per hour increase for a total of 8 hours. Break vacuum to dry air and seal.

(e) Temperature Cycle

Temperature cycle in accordance with paragraph 4.6.2 of MIL-C-39022.

(f) Seal Test

Seal test in accordance with paragraph 4.6.3 of MIL-C-39022.

3.5.1.4 Electrical Measurements

The capacitors constructed with new Source A material were given a dielectric strength test and were measured for capacitance, dissipation factor and insulation resistance. The conditions and limits were the same as those used throughout the contract in accordance with SCS301 Amendment 2. The results are tabulated below:

Part No.	No. Units	Dielectric Breakdowns	Insulation Resistance Failures	Yield %
SCS-301C105K	48	10	20	38
SCS-301B405K	48	18	30	0

3.5.1.5 Conclusions

The quality of the new Source A material was poor and the results of the new Process Evaluation were unacceptable. Accordingly, further evaluation of these capacitors was discontinued and metallized polycarbonate film from domestic Source A was disapproved as the dielectric for the capacitors of this contract.

3.5.2 Revaluation of Material Source C

3.5.2.1 Incoming Inspection of New Source C Material

Incoming inspection was performed on each roll of new polycarbonate material manufactured and metallized by domestic source C. The parameters inspected included gauge variation, metallization thickness, width variation and continuity of metallization. The material was acceptable.

3.5.2.2 Winding of 400 Capacitor Sections

Winding of all 400 capacitor sections for the additional process improvement evaluation was completed. The average winding loss was approximately 40% with an individual breakdown per type shown in Table XVI. It was more difficult to wind very small sections with thin gauge dielectric. As section size

TABLE XVI

PHASE 3

REEVALUATION OF SOURCE C MATERIAL
SECTION LOSS AT WINDING

Part No.	No. of Sections	Material Width (Inches)	Nominal Gauge (Mils)	Winding Loss
SCS-301C473K	100	0.50	0.50	43%
SCS-301B104K	100	0.50	0.25	62%
SCS-301C105K	100	1.75	0.50	29%
SCS-301B405K	100	1.75	0.25	24%

and dielectric thickness increased, so should the yield. Table XVI demonstrated this effect of degree of difficulty on winding loss. The capacitor sections were inspected for physical dimensions, margin variation, overall workmanship, and capacitance and were found to be satisfactory.

3.5.2.3 Heat Treatment

Twenty-five (25) sections of each capacitance value were subjected to one of the following heat treatments:

(a) Group 1 (100 units) heat treated at +125°C for 20 hours.

(b) Group 2 (100 units) heat trated at +130°C for 12 hours.

(c) Group 3 (100 units) heat treated at +140°C for 8 hours.

(d) Group 4 (100 units) heat treated at +85°C for 24 hours minimum, followed by 12 hours minimum at +100°C and +125°C respectively.

The capacitor sections in all four heat treatment groups were tested for dielectric strength, capacitance, dissipation factor and insulation resistance at +25°C prior to the assembly operation. No failures were encountered.

3.5.2.4 Assembly

Assembly of the 400 capacitors for process improvement evaluation was completed.

3.5.2.5 Production Burn-In

Capacitance, dissipation factor and insulation resistance measurements were recorded at +25°C before burn-in of the 400 capacitors. The dielectric strength test was also performed prior to burn-in. No failures were encountered. The 400 capacitors were burned-in for 250 hours at +125°C with 140% of rated voltage applied. There were no catastrophic failures.

3.5.2.6 Groups A and B Inspection

After burn-in the capacitors were subjected to Group A inspection in accordance with Table XII of MIL-C-39022. The capacitors passing Group A inspection were subjected to capacitance and dissipation factor measurements at -55°C, +25°C and +125°C prior to Group B life test. Insulation resistance measurements were recorded at +125°C prior to life test. Life testing was conducted at +125°C for 250 hours with 140% of rated voltage applied. Capacitance, dissipation factor and insulation resistance were measured and recorded following life test. Capacitance change due to life test was calculated. Summary results are shown in Table XVII. A summary of pre burn-in, burn-in, Group A and Group B results are shown in Table XVIII.

TABLE XVII

REEVALUATION TESTING OF SOURCE C DOMESTIC
METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 1200-9-876R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301C473K
Applicable Specification MIL-C-39022 as modified by SCS-301
Amendment 2

Lot Identification Groups 1, 2, 3, & 4
Lot Size 100
Material Source C

Summarized results of quality conformance inspection

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group A, Subgroup I 100 percent inspection				Sample size 100 Acceptance Number N/A		
Temperature cycling	3.5	4.6.2	5 cycles	100	0	
Seal	3.6	4.6.3	No leakage	100	0	
Dielectric withstanding voltage	3.7	4.6.4	400 VDC	100	0	
Insulation resistance 25°C	3.10	4.6.7	500,000 megohms min.	100	0	
Capacitance	3.8	4.6.5	.0[illegible] uf .0423 uf	100	0	
Dissipation factor	3.9	4.6.6	.3%	100	0	
Group A, Subgroup 2 Inspection level AQL = 1.0%				Sample size 13 Acceptance Number 0		
Visual and mechanical Examination (external)	3.3	4.6.1				
Physical dimensions	3.4	4.6.1		13	0	
Marking	3.23	4.6.1		13	0	
Workmanship	3.4	4.6.1		13	0	

TABLE XVII

REEVALUATION TESTING OF SOURCE C DOMESTIC
METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. -1200-9-878R-000
Contract No. DAAB05-67-C-27072
Customer Part Number SCS-301B104K
Applicable Specification MIL-C-39022 is modified by SCS-301
Amendment 2

Lot Identification Groups 1, 2, 3, & 4
Lot Size 100
Material Source C

Summarized results of quality conformance inspection

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group A, Subgroup I 100 percent inspection				Sample size 100 Acceptance Number N/A		
Temperature cycling	3.5	4.6.2	5 cycles	100	0	
Seal	3.6	4.6.3	No leakage	100	0	
Dielectric withstanding voltage	3.7	4.6.4	200 VDC	100	0	
Insulation resistance 25°C	3.10	4.6.7	500,000 megohms min.	100	0	
Capacitance	3.8	4.6.5	.110 uf .090 uf	100	0	
Dissipation factor	3.9	4.6.6	.3%	100	0	
Group A, Subgroup 2 Inspection level	AQL = 1.0%			Sample size 13 Acceptance Number 0		
Visual and mechanical Examination (external)	3.3	4.6.1				
Physical dimensions	3.4	4.6.1		13	0	
Marking	3.23	4.6.1		13	0	
Workmanship	3.24	4.6.1		13	0	

TABLE XVII

REEVALUATION TESTING OF SOURCE C DOMESTIC
METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 1200-9-880R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301C105K
Applicable Specification MIL-C-39022 as modified by SCS-301
Amendment 2

Lot Identification Groups 1, 2, 3, & 4
Lot Size 100
Material Source C

Summarized results of quality conformance inspection

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group A, Subgroup I 100 percent inspection				Sample size 100 Acceptance Number N/A		
Temperature cycling	3.5	4.6.2	5 cycles	100	0	
Seal	3.6	4.6.3	No leakage	100	0	
Dielectric withstanding voltage	3.7	4.6.4	400 VDC	100	0	
Insulation resistance 25°C	3.10	4.6.7	100,000 megohms min.	100	1	Group 2
Capacitance	3.8	4.6.5	1.10 uf 0.90 uf	100	0	
Dissipation factor	3.9	4.6.6	.3%	100	0	
Group A, Subgroup 2 Inspection level	AQL = 1.0%			Sample size 13 Acceptance Number 0		
Visual and mechanical Examination (external)	3.3	4.6.1				
Physical dimensions	3.4	4.6.1		13	0	
Marking	3.23	4.6.1		13	0	
Workmanship	3.24	4.6.1		13	0	

TABLE XVII

REEVALUATION TESTING OF SOURCE C DOMESTIC
METALLIZED POLYCARBONATE GROUP A AND B TEST

Page 4 of 8

Report No. 1200-9-882B-000
Contract No. DAAB 5-67-C-2707
Customer Part Number SCS-301B405K
Applicable Specification MIL-C-39022 as modified by SCS-301
Amendment 2

Lot Identification Groups 1, 2, 3, & 4
Lot Size 100
Material Source C

Summarized results of quality conformance inspection

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group A, Subgroup I 100 percent inspection				Sample size 100	Acceptance Number N/A	
Temperature cycling	3.5	4.6.2	5 cycles	100	0	
Seal	3.6	4.6.3	No leakage	100	0	
Dielectric withstanding voltage	3.7	4.6.4	200 VDC	100	0	
Insulation resistance 25°C	3.10	4.6.7	25,000 megohms min.	100	0	
Capacitance	3.8	4.6.5	4.40 uf 3.60 uf	100	0	
Dissipation factor	3.9	4.6.6	.3%	100	0	
Group A, Subgroup 2 Inspection level	AQL = 1.0%			Sample size 13	Acceptance Number 0	
Visual and mechanical Examination (external)	3.3	4.6.1				
Physical dimensions	3.4	4.6.1		13	0	
Marking	3.23	4.6.1		13	0	
Workmanship	3.24	4.6.1		13	0	

TABLE XVII

REEVALUATION TESTING OF SOURCE C DOMESTIC
METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 1200-9-877R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301C473K
Applicable Specification Mil-C-39022 as modified by SCS-301
Amendment 2

Lot Identification Groups 1, 2, 3, & 4
Lot Size 100
Material Source C

Summarized results of quality conformance inspection

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group B: Sample Size 100; Acceptance Number N/A						
Insulation resistance (at high ambient)	3.10	4.6.7	2,000 megohms min.	100	0	
Flashover	3.11	4.6.8	250 VDC	100	0	
Life at +125° C Volts 280 VDC	3.21	4.6.18	250 hours	100	0	
Insulation resistance at 25°C after high temperature life test	3.21	4.6.7	167,000 megohms min.	100	0	
Capacitance after high temperature life test	3.21	4.6.5	±10% of Initial Value	100	0	
Dissipation factor after high temperature life test	3.21	At +125°C 24 - 48 hrs 202- 250 hrs at +25°C	.6% Max. .6% Max. .33% Max.	100 100 100	0 0 0	

TABLE XVII

REEVALUATION TESTING OF SOURCE C DOMESTIC
METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 1200-9-879R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301B104K
Applicable Specification MIL-C-39022 as modified by SCS-301
Amendment 2

Lot Identification Groups 1, 2, 3, & 4
Lot Size 100
Material Source C

Summarized results of quality conformance inspection

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group B:				Sample Size 100	Acceptance Number N/A	
Insulation resistance (at high ambient)	3.10	4.6.7	2,000 megohms min.	100	2	1 each from Group 3 & 4
Flashover	3.11	4.6.8	125 VDC	100	0	
Life at +125° C Volts 140 VDC	3.21	4.6.18	250 hours	100	0	
Insulation resistance at 25°C after high temperature life test	3.21	4.6.7	167,000 Megohms min.	100	0	
Capacitance after high temperature life test	3.21	4.6.5	±10% of Initial Value	100	0	
Dissipation factor after high temperature life test	3.21	At +125°C 24 - 48 hrs 202 - 250 hrs at +25°C	 .6% Max. .6% Max. .33% Max.	 100 100 100	 0 0 0	

TABLE XVII

REEVALUATION TESTING OF SOURCE C DOMESTIC
METALLIZED POLYCARBONATE GROUP A AND B TEST

Page 7 of 8

Report No. 1200-9-881R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301C105K
Applicable Specification MIL-C-39022 Amendment 2 as modified by SCS-301

Lot Identification Groups 1, 2, 3, & 4
Lot Size 99
Material Source C

Summarized results of quality conformance inspection

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group B:				Sample Size 99 Acceptance Number N/A		
Insulation resistance (at high ambient)	3.10	4.6.7	1,000 Megohms min.	99	0	
Flashover	3.11	4.6.8	250 VDC	99	0	
Life at +125° C Volts 280 VDC	3.21	4.6.16	250 hours	99	0	
Insulation resistance at 25°C after high temperature life test	3.21	4.6.7	33,300 Megohms min.	99	1	Group 2
Capacitance after high temperature life test	3.21	4.6.5	±10% of Initial Value	99	0	
Dissipation factor after high temperature life test	3.21	At +125°C 24 48 hrs 202 - 250 hrs At +25°C	.6% Max. .6% Max. .33% Max.	99 99 99	0 0 0	

TABLE XVII

REEVALUATION TESTING OF SOURCE C DOMESTIC METALLIZED POLYCARBONATE GROUP A AND B TEST

Report No. 1200-9-888R-000
Contract No. DAAB05-67-C-2707
Customer Part Number SCS-301B405K
Applicable Specification MIl-C-39022 Amendment 2 as modified by SCS-301

Lot Identification Groups 1, 2, 3, & 4
Lot Size 100
Material Source C

Summarized results of quality conformance inspection

TEST	Requirement Paragraph	Test Paragraph	Inspection Conditions or Limits	Amount Tested	Amount Rejected	REMARKS
Group B:				Sample Size 100 Acceptance Number N/A		
Insulation resistance (at high ambient)	3.10	4.6.7	250 Megohms min.	100	1	Group 4
Flashover	3.11	4.6.8	125 VDC	100	0	
Life at +125° C Volts 140 VDC	3.21	4.6.18	250 hours	100	0	
Insulation resistance at 25°C after high temperature life test	3.21	4.6.7	8,325 Megohms min.	100	1	Group 2
Capacitance after high temperature life test	3.21	4.6.5	±10% of Initial Value	100	0	
Dissipation factor after high temperature life test	3.21	At +125°C 24 - 48 hrs 202 - 250 hrs. At +25°C	.6% Max. .6% Max. .33% Max.	100 100 100	0 0 0	

TABLE XVIII

PHASE 3
SUMMARY OF TEST RESULTS
SOURCE C MATERIAL

Heat Treatment	No. Units Tested	Burn-In Failures	Group A Failures	125°C IR Failures	Group B Failures	Yield %
Group 1	100	0	0	0	0	100
Group 2	100	0	1*	0	2*	97
Group 3	100	0	0	2	0	98
Group 4	100	0	0	1	0	99
Total	400	0	1	3	2	98.5

*25°C Insulation Resistance Failures

3.6 Selection of Material Source and Process Improvements

A decision was made to use metallized polycarbonate dielectric film from domestic Source C for Phases 4 and 5. It was also decided to incorporate the 250 hour accelerated burn-in and Heat Treatment 1 as integral steps of the manufacturing process. The decisions were based on the results of testing to this point, on the current knowledge of the state-of-the-art, and on engineering judgement.

3.6.1 Material Supplier

Material from the two potential domestic suppliers of metallized polycarbonate film were each evaluated twice. The reevaluations were consistent with the original evaluations. It was demonstrated that the film from domestic Source A was of poor quality, produced economically unfeasible losses during processing and testing, and was statistically an unacceptable material for the low failure rate contract objective.

The cast metallized polycarbonate film from domestic Source C, however, proved to be both mechanically and electrically of excellent quality, and was the obvious choice for use in the remaining phases of the contract.

3.6.2 Heat Treatment

Heat treatment 1 consisted of exposing the metallized polycarbonate capacitor sections to 125°C in air for 20 hours.

Examination of the electrical test results throughout the evaluation disclosed that no one heat treatment produced dramatically better results than the other heat treatments evaluated. The test results associated with Heat Treatment 1 were somewhat better than the others used in the reevaluation. This treatment provided sufficient time and temperature to shrink and condition the film without subjecting the material to excessive temperatures and was selected primarily on the basis of engineering judgement.

3.6.3 Burn-In

Adoption of a production burn-in as a process step was fast becoming an accepted practice in the manufacture of high quality and high reliability components. The more rigorous accelerated burn-in was selected. It consisted of exposing the capacitors to 140% of rated voltage for 250 hours at 125°C.

3.7 Phase 4 - First Article Tests

3.7.1 Introduction

With the completion of the Evaluation and Process Improvement Phases, the First Article Test for metallized polycarbonate capacitors was undertaken. This involved the manufacture of 560 capacitors in accordance with the modified manufacturing process followed by subjecting these capacitors to the qualification inspection electrical and environmental tests as outlined in Table IX of MIL-C-39022 and modified by SCS-301 and Contract Amendments. The 560 capacitors were comprised of the following:

Material Source	Type	Rating	No. Units
Domestic C	SCS-301B104K	0.1 mfd - 100VDC	70
	SCS-301B405K	4.0 mfd - 100VDC	70
	SCS-301C473K	0.047 mfd - 200VDC	70
	SCS-301C105K	1.0 mfd - 200VDC	70
Foreign B	SCS-301B104K	0.1 mfd - 100VDC	70
	SCS-301B405K	4.0 mfd - 100VDC	70
	SCS-301C473K	0.047 mfd - 200VDC	70
	SCS-301C105K	1.0 mfd - 200VDC	70

Descriptions of each of the test procedures and the test results are included in Sections 3.7.2 through 3.7.7.

3.7.2 Test Group I - 560 Units

VISUAL AND MECHANICAL EXAMINATION 4.6.1

All units were examined for type of materials, construction, physical dimensions, markings and external workmanship.

The units showed no evidence of damage and were properly marked. All dimensions were within the specified tolerances.

TEMPERATURE CYCLING 4.6.2

The capacitors were placed, from room temperature, into a chamber at -55°C +0 -3°C, and allowed to stabilize for a period of

30 minutes. They were removed from the low temperature chamber after the 30 minute period, allowed to set at room temperature for a period of time from 10 to 15 minutes, and then placed in a high temperature chamber at +125°C +5 -0°C, and allowed to stabilize for a 30 minute period. The capacitors were then removed from the high temperature chamber and allowed to set at ambient temperature for a period of time from 10 to 15 minutes. This series of transfers constituted one cycle. This cycle was repeated five times.

At the conclusion of the test, the capacitors were allowed to stabilize at 25°C. No measurements were made before or after the cycling.

No visual evidence of damage was observed.

SEAL TEST 4.6.3

The capacitors, while at room temperature, were immersed for a period of one minute in mineral oil maintained at a temperature of 125°C -0 +5°C. The capacitors were examined during and after the test for evidence of leakage of the impregnant or filling compound.

No visual evidence of leakage was observed.

DIELECTRIC WITHSTANDING VOLTAGE 4.6.4

A DC potential equal to 200% of rated voltage was connected from terminal to terminal for a period of one minute. This same

potential was then connected from the case to the terminals for a period of one minute. At the conclusion of this test, the capacitors were visually examined for evidence of damage.

There was no momentary or intermittent arcing or other indication of breakdown. Also, there was no visual evidence of damage at the conclusion of the test.

CAPACITANCE 4.6.5

The capacitors with values of 1.0μF and less were connected to a General Radio, Model 1608A, Impedance Bridge, operating at a frequency of 1000 Hz ± 100 Hz with a rated accuracy equal to or less than 0.05%. An external frequency of 60Hz was applied to this same bridge for measurement of the 4.0μF capacitors. capacitance was measured while the capacitors were at room ambient temperature.

All values were found to be within 10% of their rated nominal values.

DISSIPATION FACTOR 4.6.6

The dissipation factor of each capacitor was measured concurrently with capacitance as described in Paragraph 5.5.

All units were below the .3% maximum dissipation factor limit.

INSULATION RESISTANCE 4.6.7

The insulation resistance of the capacitors was measured at the rated DC voltage, utilizing a Keithley Model 610B Electrometer in conjunction with a Power Designs Model 2K10 Regulated Power Supply. The resistance from terminal to terminal at 25°C, the resistance from terminal to case at 25°C and the resistance from terminal to terminal at 125°C was measured. At the conclusion of the 125°C insulation resistance measurement the capacitors were removed from the temperature chamber.

All values were greater than the specified minimum requirements.

FLASHOVER 4.6.8

The capacitors were mounted, by their leads, in the test chamber and the pressure was reduced to .82 inches of mercury (equivalent to 80,000 feet). After the pressure had stabilized, a DC potential equal to 125% of the rated voltage was applied for a period of one minute between terminals and between each terminal and the case. After the conclusion of the electrical test, the pressure was returned to ambient and the capacitors were removed from the test chamber and visually examined for evidence of damage.

There was no evidence of momentary or intermittent arcing or other indication of breakdown during the tests. Also, there

was no visible evidence of damage at the conclusion of the test.

3.7.3 Test Group II - 48 Units

VIBRATION, HIGH FREQUENCY 4.6.9

The capacitors were encapsulated in a hard wax-like epoxy, the vibration transmissibility of which had previously been tested to 2000 Hz and found to be satisfactory. The capacitors were epoxied to 5" x 5" aluminum plates and the leads were supported by insulated solder terminals located approximately 1/2" from the seal end of the capacitors.

These plates were then forwarded to Continental Testing Laboratories, Inc. for vibration over the frequency range of 10-2000Hz at an amplitude of .06" DA or 20 g's, whichever, was the lesser. The frequency was varied at a logarithmic rate such that it took twenty minutes to traverse the frequency range of 10-2000-10Hz.

The vibration was performed in two mutually perpendicular axes for four hours in each of the radial and axial planes for a total of eight hours. Throughout the test, a potential of 50% of the rated DC voltage was applied between the terminals of the capacitors. During the last cycle in each axis, the capacitors were monitored for any electrical discontinuities or shorts.

No opens or shorts were detected during the test.

SALT SPRAY 4.6.10

The specimens were mounted in an Associated Testing Laboratories, Model SS-3-4, Salt Spray Chamber so that the longitudinal axis was approximately at a 15° angle from the vertical and parallel to the principle direction of horizontal flow of the fog through the chamber.

The chamber was programmed to operate at a temperature of 35°C +2 -3°F. A 20% salt solution was used to generate the fog and was applied for a period of 48 hours.

At the completion of the 48 hour period, the devices were removed from the chamber, and salt deposits were removed by washing them in running water at a temperature of less than 37.8°C. After a 24 hour drying period, the capacitors were visually examined for evidence of harmful corrosion and obliteration of markings.

At least 90% of all exposed metallic surfaces were protected by the finish and the markings remained legible.

IMMERSION 4.6.11

The capacitors were immersed for a period of one hour in a saturated solution of sodium chloride and water at a temperature of 65° +5 -0°C, followed by immersion in a bath consisting of a

saturated solution of sodium chloride and water at a temperature of 0° ±3°C for a period of one hour. This cycle was repeated five times.

At least four hours, and not more than twenty-four after the completion of the final cycle, the dielectric withstanding voltage and insulation resistance of the capacitor and the capacitor to its case was measured. Capacitance and dissipation factor were also measured at 25°C. The capacitors were then examined for harmful or extensive corrosion and obliteration of markings.

No discrepancies were noted.

3.7.4 Test Group III - 48 Units

SOLDERABILITY 4.6.12

Prior to the application of flux and solder, 50% of the capacitors were subjected to aging by immersion in a noncorrosive container of boiling, distilled water for a period of one hour. No aging was performed on the remaining capacitors.

The terminals of all the capacitors were then immersed in flux conforming to type W of specification MIL-F-14256 to within 1/8" of the capacitor body, at room ambient temperature, for a period of 5 to 10 seconds. The dross and burned flux was then skimmed from the surface of the molten solder. Following this the capacitor was installed in the capacitor dip machine and dipped into the solder at the

rate of 1 ± 1/4" per second, with a dwell time at the required depth of 5 ± 1/2 seconds and withdrawn at the rate of 1 ± 1/4" per second.

After the dipping process, the capacitor lead was allowed to cool in air and the process was performed on the other lead. The residue flux was removed from the terminations by dipping in isopropyl alcohol and cleaning with a soft cloth.

After the cleaning process, the surface of each lead was examined using a microscope with a 10 power magnification, for 95% coverage of a continuous new solder coat and checked that pinholes or voids were not concentrated in one area and did not exceed 5% of the total area.

The leads were found to be covered uniformly with a smooth bright film of solder, and there was no evidence of pinholes or concentration of voids in the solder coverage.

SHOCK, MEDIUM IMPACT 4.6.13

The capacitors were encapsulated in a hard wax-like epoxy, the transmissibility of which had previously been tested and found to be satisfactory. The encapsulated capacitors were attached to 5" x 5" aluminum plates and the leads were supported by insulated solder terminals located approximately 1/2" from the seal end of the capacitors.

These plates were then forwarded to Continental Testing Laboratories, Inc. for medium impact shock. The specimens were dropped a total of 18 times, 3 blows or 3 shocks in each of the 3 axes. The peak shock value indicated was 100 g's with a pulse duration of 6 ms. During the test, a DC potential equal to 50% of the rated voltage was applied between the terminals, and a time monitor (capable of detecting transients in excess of 0.5 msec) was connected to monitor the voltage across each capacitor in order to determine any electrical failures or indication of malfunctions during the Shock Test.

Following the application of the final shock, the capacitors were removed from the shock machine and visually examined for damage.

During the Shock Test there were no opens or shorts detected.

There was no evidence of fractures or other visible mechanical damage.

TEMPERATURE CYCLING 4.6.2

The capacitors were placed, from room temperature, into a chamber at -55°C +0 -3°C, and allowed to stabilize for a period of 30 minutes. They were removed from the low temperature chamber after the 30 minute period, allowed to set at room temperature for a period of time from 10 to 15 minutes, and then placed in a high temperature

chamber at +125°C +3 -0°C, and allowed to stabilize for a 30 minute period. The capacitors were then removed from the high temperature chamber and allowed to set at ambient temperature for a period of time from 10 to 15 minutes. This series of transfers constituted one cycle. This cycle was repeated five times.

At the conclusion of the test, the capacitors were allowed to stabilize at 25°C. No measurements were made before or after the cycling.

No visual evidence of damage was observed.

MOISTURE RESISTANCE 4.6.14

The capacitors were mounted by their normal mounting means and installed in a horizontal position in a moisture resistance chamber.

The specimens were then conditioned for twenty-four hours at 50°C with an uncontrolled humidity and subjected to ten continuous cycles of humidity environment consisting of a 2 1/2 hour rise to 65°C and stabilization at that temperature for three hours while maintaining 90 to 98% relative humidity. The temperature was then reduced over a 2 1/2 hour period to 25°C, while maintaining 80 to 98% relative humidity, and then again increased for the next 2 1/2 hours to 65°C, while maintaining a 90 to 98% relative humidity. The temperature was maintained at 65°C for three hours, while maintaing 90 to 98% relative

humidity, and then the chamber temperature was reduced to 25°C in 2 1/2 hours while maintaining 80 to 98% relative humidity.

The two alternations at high temperature occurred over a 16 hour period at the conclusion of which, the temperature was stabilized for a period of three hours. At the end of this period, the devices were subjected to a temperature of -10°C for a period of three hours. At the end of this three hour period, the devices were installed on a vibrator and vibrated for fifteen minutes at room ambient temperature with a sinewave acceleration having an amplitude of .06" DA and a frequency varying uniformly between 10 and 55 cycles per second. The frequency sweep from 10 to 55 and return to 10 cycles was traversed in approximately one minute.

During the two humidity-temperature cycles of the first six steps of all humidity cycles, a polarizing potential of 100 VDC was applied from terminal to terminal of one-half of the test samples, while no potential was applied to the remaining half.

After the final cycle, the capacitors were conditioned at 25°C -5° +10°C at a relative humidity of less than 80% for a period of between 22 and 24 hours. At this time the dielectric withstanding voltage and insulation resistance of the capacitor and the capacitor to its case was measured. Capacitance and dissipation factor were also measured at 25°C.

Concluding the electrical test, the capacitors were visually examined for evidence of extensive corrosion and obliteration of markings.

No discrepancies were noted.

3.7.5 Test Group IV - 96 Units

TERMINAL STRENGTH 4.6.15

The terminal strength test as specified in Method 211 of MIL-STD-202 was performed as follows:

Pull Test (Test Condition A) - The capacitor was clamped by one lead and a force of 4 1/2 pounds was applied to the other lead in the direction of the axes of the terminations for a period of 5 to 10 seconds.

Bend Test (Test Condition C) - The body of the capacitor was clamped in a fixture with a load of 2 1/2 pounds suspended at a point within 1/4 inch from the free end of the terminal. The body of the part was slowly inclined so as to bend the terminal through 90° and then return it to normal position with the entire action limited to one vertical plane. A bend through 90° and return to normal position is defined as one bend. Consecutive bends were in the

same direction and the load was restricted so that the bend started 3/32 ± 1/32 inch from the body of the component part. The rate of bending was approximately 3 seconds per bend in each direction.

Twist Test (Test Condition D) - The capacitor was clamped in a suitable fixture and each lead was bent to a 90° angle at a point 1/4" from the body of the capacitor, with a radius of bend approximately 1/32". The terminals were then clamped to within 3/64" ± 1/64" of the bend, and the body of the capacitor was rotated about the original axis of the bent terminals through 360° in alternating directions for three rotations at the rate of approximately five seconds per rotation.

At the conclusion of all testing, the capacitor and terminals were visually examined for signs of mechanical damage.

There was no evidence of mechanical damage, and all leads were intact at the conclusion of the test.

LOW TEMPERATURE AND CAPACITANCE CHANGE WITH TEMPERATURE 4.6.16

The capacitors were placed in a temperature chamber maintained at -55 +0 -5°C and a DC potential equal to the rated voltage

was applied at this temperature for 48 ± 4 hours. At the conclusion of this 48 hour period, the capacitance was measured at low temperature, and the units were removed from the temperature chamber and allowed to stabilize at 25° ± 5°C where the capacitance was again measured.

The capacitors were then stabilized in a high temperature chamber at 125 ± 3°C and the capacitance was again measured. The capacitors were returned to ambient temperature of 25° ± 5°C, and the capacitance again measured.

The measurement of the capacitance at each of the temperatures consisted of two successive readings taken at five minute intervals to indicate that no change in capacitance had occurred.

At the conclusion of this test, the capacitors were visually examined for evidence of breakdown, arcing, open and short circuiting and other visible mechanical damage.

All capacitance changes from the value at 25°C to the low and high ambient test temperature were found to be within the specified limits.

3.7.6 Test Group V - 48 Units

FAULT COUNT 4.6.17

Fault count testing was performed by Continental Testing Laboratories, Inc. as outlined below.

The capacitors were mounted on a tubular glass fixture which, in turn, was placed inside a temperature chamber. A fault count monitoring circuit was connected to each capacitor through a current limiting resistor. The other side of the capacitor was connected to a 100 VDC or 200 VDC buss, depending upon the voltage rating of the capacitor. Temperature and high voltage were then increased to 125°C and 100 VDC and 200 VDC, respectively.

The chamber temperature, high voltage power supplies and monitoring circuits were monitored daily throughout the remainder of the test. At times during the test when a counter circuit appeared not to be counting, it was removed and the capacitor being monitored switched to a space monitoring circuit. The suspected faulty circuit was then checked and repaired, if necessary, before being returned to the test setup. This technique was used to confirm whether the capacitor was counting, or the monitoring channel malfunctioning. Once a week throughout the test, each monitor circuit was subjected to a test pulse to insure proper operation of the circuit. The following is the procedure used for calibrating and checking both the individual monitoring circuits and the test setup as a whole.

Each monitoring circuit was equipped with a current limiting resistor which was in series with the capacitor to be monitored. The resistor's value was computed using the formula $R = \frac{0.025}{C}$, where R

was resistance in ohms and C the capacitance of the test capacitor in farads. Listed below are the values for each capacitor's current limiting resistor.

Capacitance	Voltage	Current Limiting Resistor* Value Used	Value Calc.
.047μF	200VDC	560K	531K
.1μF	100VDC	240K	250K
1.0μF	200VDC	24K	25K
4.0μF	100VDC	6.7K	6.2K

*All resistors 1/2W 5%.

The individual monitoring circuits were then calibrated to insure that a 3 ms +5V pulse at 15 pps would trigger the circuit, but a pulse 80% of the amplitude would not trigger the circuit. 5VDC was then applied to the circuit to trigger the circuit on. The circuit was kept on until the Low IR lamp circuit had been adjusted to illuminate between 1.8 and 2 minutes after the trigger voltage had been applied. This concluded the calibration of the monitoring circuits.

Sample capacitors of the same physical size and electrical characteristics as the ones to be tested were mounted on the tubular glass fixture and connected to the monitoring circuits. The chamber temperature was increased to 125°C and stabilized. During the next four hours, the test setup was checked for proper operation. This included checking to insure that the monitor channels would detect

breakdowns and low IR values. A 1 megohm resistor was used to short each capacitor individually while observing the monitoring circuit for one count each time the capacitor was shorted. The low IR lamps were checked for operation after 1.8 to 2.0 minutes of low IR, as simulated by the 1 meg resistor shorted across the capacitor. After a thorough check of the test setup had been completed, the chamber temperature was reduced to ambient room temperature, the high voltage DC reduced to 0 VDC and the sample capacitors removed and visually inspected. At this time, the test capacitors were placed in the chamber.

The test specifications required that after 500 hours at 125°C and rated voltage, the capacitors conform to the following requirements. No visible evidence of damage.

Daily counts, as registered by monitoring circuit, not to exceed 4C or 1, whichever was greater, for any one capacitor.

The total number of counts was not to exceed 6C or 1, whichever was greater. C is the nominal capacitance of the capacitors.

Periods of Low IR not to exceed two minutes for any capacitor tested.

The 500 hour fault count test was completed with all parts conforming to the requirements.

3.7.7 Test Group VI

LIFE TEST 4.5.18.1

LIFE (ACCELERATED) (120 Units)

The capacitors were subjected to a 2,000 -0 to +8 hour life test at 125°C -0 +4°C with an applied DC potential equal to 140% of rated voltage.

LIFE (RATED) (200 Units)

The capacitors were subjected to a 2,000 -0 +8 hour life test at 125°C -0 +4°C with an applied DC potential equal to the rated voltage.

LIFE TEST PROCEDURES

The life test capacitors were mounted in the chamber at a distance of approximately 1 1/4" from one another to insure adequate circulation. The voltage to each capacitor was applied through an individual current-limiting resistor determined by the formula $R = \frac{0.025}{C}$ where C was the nominal capacitance in farads and R was in ohms not to exceed 2 megohms. The dissipation factor of each sample was measured at 125°C after 24, but not more than 48 hours from the start of the conditioning, and also at some time during the last 48 hours of the conditioning. During these measurements, the DC voltage was removed from the capacitor terminals

At the conclusion of the 250, 1000 and 2,000 hour test periods, the capacitors were returned to ambient temperature where capacitance, dissipation factor and insulation resistance were measured. After these measurements, the capacitors were visually examined for evidence of corrosion or mechanical damage.

All measurements were found to be within the specified limits and no visual evidence of corrosion or mechanical damage was observed.

3.7.8 Conclusions

The preproduction or First Article Tests were performed using Metallized Polycarbonate Capacitors made from material supplied by foreign Source B and domestic Source C with satisfactory results. Table XIX summarize these results which showed no failures.

With the successful performance of the First Article Tests it was concluded that domestic Source C film was equivalent to that of foreign Source B and was of sufficiently high quality to attain the contract reliability objective. Phase 5 involving the Production Run was undertaken.

3.8 Phase 5 - Production Run of Metallized Polycarbonate Capacitors

3.8.1 Manufacture and Burn-In

The production run was manufactured using the detailed production process developed during the Process Improvement and

TABLE XIX

PHASE 4
SUMMARY OF TEST RESULTS - FIRST ARTICLE SAMPLES
SPECIFICATION MIL-C-39022

Test	Test Paragraph	Samples Tested	Failed
Group 1			
Visual and Mechanical Examination	3.23	560	0
Marking	Thru	560	0
Workmanship (external)	3.24.3	560	0
Temperature cycling	3.5	560	0
Seal	3.6	560	0
Dielectric withstanding voltage	3.7	560	0
Capacitance	3.8	560	0
Dissipation Factor	3.9	560	0
Insulation Resistance	3.10	560	0
Flashover	3.11	560	0
Group 2			
Vibration	3.12	48	0
Salt Spray	3.13	48	0
Immersion	3.14	48	0

TABLE XIX (CONT'D)

Test	Test Paragraph	Samples Tested	Failed
Group 3			
Solderability	3.15	48	0
Shock, Medium Impact	3.16	48	0
Moisture Resistance	3.17	48	0
Group 4			
Terminal Strength	3.18	96	0
Low Temperature and Capacitance Change with Temperature	3.19	96	0
Group 5			
Fault Count 500 Hours	3.20	48	0
Group 6			
Life (accelerated)	3.21	320	0
Life (rated)	3.21	200	0

First Article production phases of the Production Engineering Measure. Since the manufacturing facility in which the First Article and production run was fabricated was dedicated to the production of high quality hermetically sealed capacitors, the state-of-the-art in the production areas was such that all necessary and unique production equipment had previously been developed within the company. Therefore it was not necessary to design, develop, manufacture, or procure either special tooling or design, procure, or fabricate limited production equipment in the performance of this Production Engineering Measure.

The production run of 11,550 capacitors consisted of the following listed part numbers and quantities.

Part Number	Capacitance ±10%	Voltage Rating	Quantity
SCS-301B104K	0.10	100 VDC	1925
SCS-301B105K	1.0	100 VDC	1925
SCS-301B405K	4.0	100 VDC	1925
SCS-301C473K	0.047	200 VDC	1925
SCS-301C334K	0.33	200 VDC	1925
SCS-301C105K	1.0	200 VDC	1925

Manufacture of the entire production lot of 11,550 capacitors was completed with no special problems encountered. All were subjected to the burn-in consisting of the application of 140% of rated voltage for 250 hours at 125°C. The lot satisfactorily completed burn-in.

3.8.2 Group A Tests and Preliminary Measurements

After burn-in the capacitors were subjected to the Group A tests specified in Table XII of MIL-C-39022. The entire lot met the requirements and limits of the Group A testing. See Table XX which is the applicable portion of Table XII of MIL-C-39022.

Initial capacitance of each capacitor was recorded so that a delta C value could be established for each part at the 1000 hour and 10,000 hour measurement points. With a requirement for an acceptable part for test as nominal capacitance ±10%, the test results are listed in Table XXI for each part. Initial dissipation factor measurements are recorded in Table XXII. These data include a .6% bridge and associated reading interface error in addition to the initial .3% DF limit. All parts were within limits. All parts were mounted on test racks and placed into the test ovens to be tested for 10,000 hours.

3.8.2.1 Computer Codes to Histograms

Capacities

Columns 1 and 2 - Capacity in microfarads

Column 3 - Number of units in the capacity range listed in columns 1 and 2

Computer X's - Relative display of column 3 numbers.

Delta Capacities

Columns 1 and 2 - Capacity deviation increments

Column 3 - Number of units in the increment listed in columns 1 and 2

TABLE XX

GROUP A INSPECTION
MIL-C-39022

Table XII - Group A inspection.

Examination or test	Requirement paragraph	Method paragraph	AQL (Percent defective)1/	
			Major	Minor
Subgroup 1				
Temperature cycling	3.5	4.6.2	N/A 100% inspection	
Seal	3.6	4.6.3		
Dielectric strength	3.7	4.6.4		
Insulation resistance at 25°C	3.10	4.6.7		
Capacitance	3.8	4.6.5		
Dissipation factor	3.9	4.6.6		
Subgroup 2				
Visual and mechanical examination (external)		4.6.1	1	4
Material	3.3			
Physical dimensions	3.4			
Marking2/	3.23			
Workmanship	3.24			

1/ Major and minor defects shall be as defined in MIL-STD-105.
2/ Marking defects are based on visual examination and will be charged only for illegible, incomplete, or incorrect marking. Any subsequent electrical defects shall not be used as a basis for determining marking defects.

TABLE XXI

INITIAL CAPACITIES

```
          SCS-301B104K              0 HOURS
NO OF DATA POINTS    1925  MINIMUM      0.0918  #    85  MAXIMUM      0.1093  #  289   MEDIAN      0.1019
   MEAN VALUE    0.1017    STANDARD DEVIATION     0.0028
    FROM    TO     COUNT
    0.091   0.092     2
    0.092   0.093     2
    0.093   0.094     8  .XX
    0.094   0.095    17  .XXXXXX
    0.095   0.096    30  .XXXXXXXXXXX
    0.096   0.097    62  .XXXXXXXXXXXXXXXXXXXXX
    0.097   0.098    99  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.098   0.099   144  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.099   0.100   153  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.100   0.101   237  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.101   0.102   247  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.102   0.103   268  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.103   0.104   219  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.104   0.105   195  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.105   0.106   122  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.106   0.107    67  .XXXXXXXXXXXXXXXXXXXXXXX
    0.107   0.108    39  .XXXXXXXXXXXXX
    0.108   0.109     9  .XXX
    0.109   0.110     5  .X
```

TABLE XXI

INITIAL CAPACITIES

SCS-301B105K 0 HOURS

NO OF DATA POINTS 1925 MINIMUM 0.9378 # 1487 MAXIMUM 1.0994 # 1904 MEDIAN 1.0508
MEAN VALUE 1.0484 STANDARD DEVIATION 0.0256

FROM	TO	COUNT	
0.930	0.940	1	
0.940	0.950	0	
0.950	0.960	1	
0.960	0.970	7	.X
0.970	0.980	10	.XX
0.980	0.990	25	.XXXXXX
0.990	1.000	29	.XXXXXXX
1.000	1.010	39	.XXXXXXXXX
1.010	1.020	86	.XXXXXXXXXXXXXXXXXXXXX
1.020	1.030	162	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.030	1.040	231	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.040	1.050	338	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.050	1.060	370	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.060	1.070	290	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.070	1.080	199	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.080	1.090	113	.XXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.090	1.100	24	.XXXXXX

TABLE XXI

INITIAL CAPACITIES

SCS-301B405K 0 HOURS

NO OF DATA POINTS 1925 MINIMUM 3.8070 # 484 MAXIMUM 4.3950 # 1365 MEDIAN 4.0900
MEAN VALUE 4.0894 STANDARD DEVIATION 0.1155

FROM	TO	COUNT	
3.800	3.820	1	
3.820	3.840	3	.X
3.840	3.860	3	.X
3.860	3.880	10	.XXXX
3.880	3.900	10	.XXXX
3.900	3.920	16	.XXXXXXX
3.920	3.940	33	.XXXXXXXXXXXXXX
3.940	3.960	46	.XXXXXXXXXXXXXXXXXXX
3.960	3.980	62	.XXXXXXXXXXXXXXXXXXXXXXXXXX
3.980	4.000	77	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.000	4.020	105	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.020	4.040	135	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.040	4.060	166	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.060	4.080	180	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.080	4.100	210	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.100	4.120	181	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.120	4.140	182	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.140	4.160	143	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.160	4.180	104	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.180	4.200	76	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.200	4.220	62	.XXXXXXXXXXXXXXXXXXXXXXXXXX
4.220	4.240	45	.XXXXXXXXXXXXXXXXXXX
4.240	4.260	22	.XXXXXXXXX
4.260	4.280	22	.XXXXXXXXX
4.280	4.300	11	.XXXXX
4.300	4.320	9	.XXXX
4.320	4.340	6	.XX
4.340	4.360	1	
4.360	4.380	1	
4.380	4.400	3	.X

TABLE XXI

INITIAL CAPACITIES

```
            SCS-301C473K                 0 HOURS
NO OF DATA POINTS     1925  MINIMUM       0.0430  #  1729  MAXIMUM       0.0506  # 1406    MEDIAN       0.0469
  MEAN VALUE        0.0469    STANDARD DEVIATION      0.0014
   FROM    TO      COUNT
    0.043      0.043     1
    0.043      0.043     2   .X
    0.043      0.044     5   .XX
    0.044      0.044     5   .XX
    0.044      0.044    21   .XXXXXXXXXX
    0.044      0.044    11   .XXXXX
    0.044      0.045    34   .XXXXXXXXXXXXXXXXX
    0.045      0.045    39   .XXXXXXXXXXXXXXXXXXX
    0.045      0.045    75   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.045      0.045    39   .XXXXXXXXXXXXXXXXXXX
    0.045      0.046    96   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.046      0.046    67   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.046      0.046   113   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.046      0.046    93   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.046      0.047   157   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.047      0.047   103   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.047      0.047   192   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.047      0.047    97   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.047      0.048   168   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.048      0.048    95   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.048      0.048   119   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.048      0.048    69   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.048      0.049   100   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.049      0.049    49   .XXXXXXXXXXXXXXXXXXXXXXXX
    0.049      0.049    65   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.049      0.049    35   .XXXXXXXXXXXXXXXXX
    0.049      0.050    39   .XXXXXXXXXXXXXXXXXXX
    0.050      0.050     9   .XXXX
    0.050      0.050    17   .XXXXXXXX
    0.050      0.050     6   .XXX
    0.050      0.051     3   .X
    0.051      0.051     1
```

TABLE XXI

INITIAL CAPACITIES

SCS-301C334K 0 HOURS

NC OF DATA POINTS 1925 MINIMUM 0.2984 # 704 MAXIMUM 0.3591 # 27 MEDIAN 0.3279
MEAN VALUE 0.3277 STANDARD DEVIATION 0.0135

FROM	TO	COUNT
0.298	0.300	4
0.300	0.302	14
0.302	0.304	24
0.304	0.306	27
0.306	0.308	27
0.308	0.310	44
0.310	0.312	48
0.312	0.314	64
0.314	0.316	75
0.316	0.318	95
0.318	0.320	109
0.320	0.322	96
0.322	0.324	124
0.324	0.326	109
0.326	0.328	108
0.328	0.330	116
0.330	0.332	118
0.332	0.334	135
0.334	0.336	111
0.336	0.338	97
0.338	0.340	83
0.340	0.342	64
0.342	0.344	51
0.344	0.346	49
0.346	0.348	40
0.348	0.350	35
0.350	0.352	23
0.352	0.354	18
0.354	0.356	13
0.356	0.358	2
0.358	0.360	2

TABLE XXII

INITIAL DF

```
         SCS-301B104K               0 HOURS
NO OF DATA POINTS     1925  MINIMUM       1.0000  #  1602  MAXIMUM       30.0000  # 1734    MEDIAN      12.0000
  MEAN VALUE       11.8270    STANDARD DEVIATION       3.3009
   FROM    TO      COUNT
    0.000      1.000     1
    1.000      2.000     2
    2.000      3.000     5   .X
    3.000      4.000     6   .X
    4.000      5.000    10   .XXX
    5.000      6.000    22   .XXXXXX
    6.000      7.000    66   .XXXXXXXXXXXXXXXXXX
    7.000      8.000   108   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    8.000      9.000   197   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    9.000     10.000   212   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   10.000     11.000   326   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   11.000     12.000   297   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   12.000     13.000   233   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   13.000     14.000   175   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   14.000     15.000    82   .XXXXXXXXXXXXXXXXXXXXXXX
   15.000     16.000    51   .XXXXXXXXXXXXXX
   16.000     17.000    32   .XXXXXXXXX
   17.000     18.000    25   .XXXXXXX
   18.000     19.000    16   .XXXX
   19.000     20.000     9   .XX
   20.000     21.000    11   .XXX
   21.000     22.000    12   .XXX
   22.000     23.000    10   .XXX
   23.000     24.000     6   .X
   24.000     25.000     1
   25.000     26.000     4   .X
   26.000     27.000     1
   27.000     28.000     2
   28.000     29.000     2
   29.000     30.000     1
```

TABLE XXII

INITIAL DF

SCS-301B105K 0 HOURS

```
NO OF DATA POINTS     1925  MINIMUM      35.0000  #  1512  MAXIMUM      60.0000  # 1313   MEDIAN      45.0000
   MEAN VALUE       45.6582    STANDARD DEVIATION        4.4970
   FROM     TO       COUNT
    34.000     35.000     1
    35.000     36.000     7   .XXX
    36.000     37.000    19   .XXXXXXXXX
    37.000     38.000    35   .XXXXXXXXXXXXXXXXX
    38.000     39.000    80   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    39.000     40.000   101   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    40.000     41.000   125   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    41.000     42.000   135   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    42.000     43.000   153   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    43.000     44.000   144   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    44.000     45.000   169   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    45.000     46.000   178   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    46.000     47.000   182   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    47.000     48.000   136   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    48.000     49.000   122   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    49.000     50.000    67   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    50.000     51.000    54   .XXXXXXXXXXXXXXXXXXXXXXXXXXX
    51.000     52.000    63   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    52.000     53.000    45   .XXXXXXXXXXXXXXXXXXXXXX
    53.000     54.000    34   .XXXXXXXXXXXXXXXXX
    54.000     55.000    21   .XXXXXXXXXX
    55.000     56.000    23   .XXXXXXXXXXX
    56.000     57.000    13   .XXXXXX
    57.000     58.000     3   .X
    58.000     59.000    10   .XXXXX
    59.000     60.000     5   .XX
```

TABLE XXII

INITIAL DF

SCS-301B405K 0 HOURS

NO OF DATA POINTS 1925 MINIMUM 4.0000 # 376 MAXIMUM 64.0000 # 230 MEDIAN 30.0000

MEAN VALUE 29.7538 STANDARD DEVIATION 4.2579

FROM	TO	COUNT	
2.000	4.000	2	
4.000	6.000	9	.X
6.000	8.000	8	.X
8.000	10.000	6	
10.000	12.000	3	
12.000	14.000	2	
14.000	16.000	2	
16.000	18.000	1	
18.000	20.000	6	
20.000	22.000	15	.XX
22.000	24.000	17	.XX
24.000	26.000	124	.XXXXXXXXXXXXXXXXXXX
26.000	28.000	349	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
28.000	30.000	598	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
30.000	32.000	499	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
32.000	34.000	140	.XXXXXXXXXXXXXXXXXXXXXX
34.000	36.000	68	.XXXXXXXXXX
36.000	38.000	45	.XXXXXXX
38.000	40.000	20	.XXX
40.000	42.000	6	
42.000	44.000	1	
44.000	46.000	1	
46.000	48.000	0	
48.000	50.000	1	
50.000	52.000	0	
52.000	54.000	0	
54.000	56.000	0	
56.000	58.000	1	
58.000	60.000	0	
60.000	62.000	0	
62.000	64.000	1	

TABLE XXII

INITIAL DF

SCS-301C473K   0 HOURS

```
NO OF DATA POINTS    1925  MINIMUM     1.0000  #    2  MAXIMUM    29.0000  # 1769   MEDIAN    12.0000
  MEAN VALUE      12.2987   STANDARD DEVIATION     5.3807
   FROM    TO      COUNT
    0.000     1.000   26   .XXXXXXXXXX
    1.000     2.000   28   .XXXXXXXXXXX
    2.000     3.000   35   .XXXXXXXXXXXXXX
    3.000     4.000   23   .XXXXXXXXX
    4.000     5.000   30   .XXXXXXXXXXXX
    5.000     6.000   50   .XXXXXXXXXXXXXXXXXXXX
    6.000     7.000   64   .XXXXXXXXXXXXXXXXXXXXXXXXX
    7.000     8.000  107   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    8.000     9.000  175   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    9.000    10.000  173   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   10.000    11.000  238   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   11.000    12.000  216   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   12.000    13.000  196   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   13.000    14.000  116   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   14.000    15.000   81   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   15.000    16.000   52   .XXXXXXXXXXXXXXXXXXXX
   16.000    17.000   38   .XXXXXXXXXXXXXXX
   17.000    18.000   33   .XXXXXXXXXXXXX
   18.000    19.000   21   .XXXXXXXX
   19.000    20.000   19   .XXXXXXX
   20.000    21.000   16   .XXXXXX
   21.000    22.000   38   .XXXXXXXXXXXXXXX
   22.000    23.000   31   .XXXXXXXXXXXX
   23.000    24.000   48   .XXXXXXXXXXXXXXXXXXX
   24.000    25.000   27   .XXXXXXXXXX
   25.000    26.000   21   .XXXXXXXX
   26.000    27.000   17   .XXXXXXX
   27.000    28.000    2
   28.000    29.000    4   .X
```

TABLE XXII

INITIAL DF

SCS-301C334K   0 HOURS

```
C OF DATA POINTS    1925  MINIMUM      2.0000  #  1574  MAXIMUM    60.0000  # 1809   MEDIAN     30.0000
 MEAN VALUE      34.0306    STANDARD DEVIATION      11.5601
  FROM    TO       COUNT
   0.000      2.000     1
   2.000      4.000     8   .XX
   4.000      6.000    12   .XXXX
   6.000      8.000    13   .XXXX
   8.000     10.000    14   .XXXXX
  10.000     12.000    16   .XXXXX
  12.000     14.000    11   .XXX
  14.000     16.000    11   .XXX
  16.000     18.000    20   .XXXXXXX
  18.000     20.000    15   .XXXXX
  20.000     22.000    35   .XXXXXXXXXXXX
  22.000     24.000   136   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  24.000     26.000   236   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  26.000     28.000   274   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  28.000     30.000   218   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  30.000     32.000   110   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  32.000     34.000    41   .XXXXXXXXXXXXXX
  34.000     36.000    22   .XXXXXXX
  36.000     38.000    13   .XXXX
  38.000     40.000    18   .XXXXXX
  40.000     42.000    83   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  42.000     44.000   112   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  44.000     46.000   153   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  46.000     48.000   112   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  48.000     50.000    88   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  50.000     52.000    45   .XXXXXXXXXXXXXXXX
  52.000     54.000    44   .XXXXXXXXXXXXXXX
  54.000     56.000    35   .XXXXXXXXXXXX
  56.000     58.000    11   .XXX
  58.000     60.000    18   .XXXXXX
```

TABLE XXII

INITIAL DF

SCS-301C105K 0 HOURS

```
NO OF DATA POINTS    1925  MINIMUM      0.9034  #   687  MAXIMUM     1.0896  #  195   MEDIAN      0.9671
  MEAN VALUE        0.9659   STANDARD DEVIATION     0.0215
   FROM    TO     COUNT
   0.900   0.910     2
   0.910   0.920    14  .XXX
   0.920   0.930    54  .XXXXXXXXXXXX
   0.930   0.940   126  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.940   0.950   182  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.950   0.960   276  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.960   0.970   434  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.970   0.980   392  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.980   0.990   286  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.990   1.000   125  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   1.000   1.010    27  .XXXXXX
   1.010   1.020     3
   1.020   1.030     0
   1.030   1.040     0
   1.040   1.050     1
   1.050   1.060     1
   1.060   1.070     1
   1.070   1.080     0
   1.080   1.090     1
```

TABLE XXII

INITIAL DF

SCS-301C105K   0 HOURS

NO OF DATA POINTS 1925 MINIMUM 27.0000 # 1296 MAXIMUM 60.0000 # 1534 MEDIAN 43.0000
MEAN VALUE 43.5361 STANDARD DEVIATION 5.2805

FROM	TO	COUNT
26.000	27.000	1
27.000	28.000	0
28.000	29.000	0
29.000	30.000	3
30.000	31.000	2
31.000	32.000	1
32.000	33.000	9
33.000	34.000	18
34.000	35.000	37
35.000	36.000	73
36.000	37.000	93
37.000	38.000	113
38.000	39.000	108
39.000	40.000	125
40.000	41.000	134
41.000	42.000	151
42.000	43.000	146
43.000	44.000	139
44.000	45.000	139
45.000	46.000	143
46.000	47.000	93
47.000	48.000	88
48.000	49.000	71
49.000	50.000	40
50.000	51.000	28
51.000	52.000	41
52.000	53.000	27
53.000	54.000	35
54.000	55.000	26
55.000	56.000	9
56.000	57.000	11
57.000	58.000	8
58.000	59.000	6
59.000	60.000	7

Computer X's - Relative display of column 3 numbers.

Total Quantity - The total of the number measured differs from the initial capacity total numbers on some histograms because the computer program did not itemize units exhibiting 0 capacity change.

Dissipation Factor

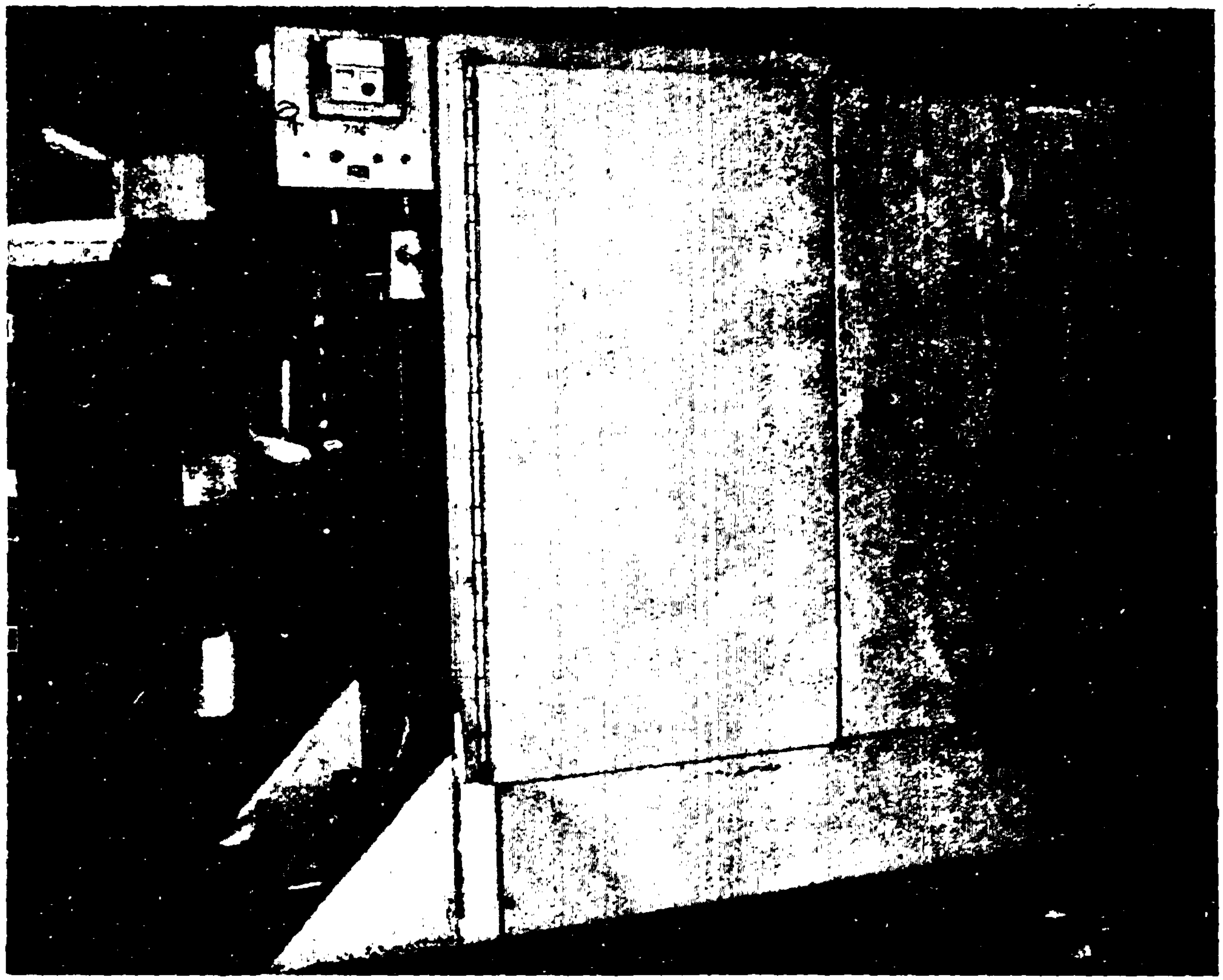
Columns 1 and 2 - Percent DF. Move decimal point 2 places to the left and read % in both histograms and listing

Column 3 - Number of units between the increments listed in columns 1 and 2

Computer X's - Relative display of column 3 numbers.

3.8.3 Test Facilities

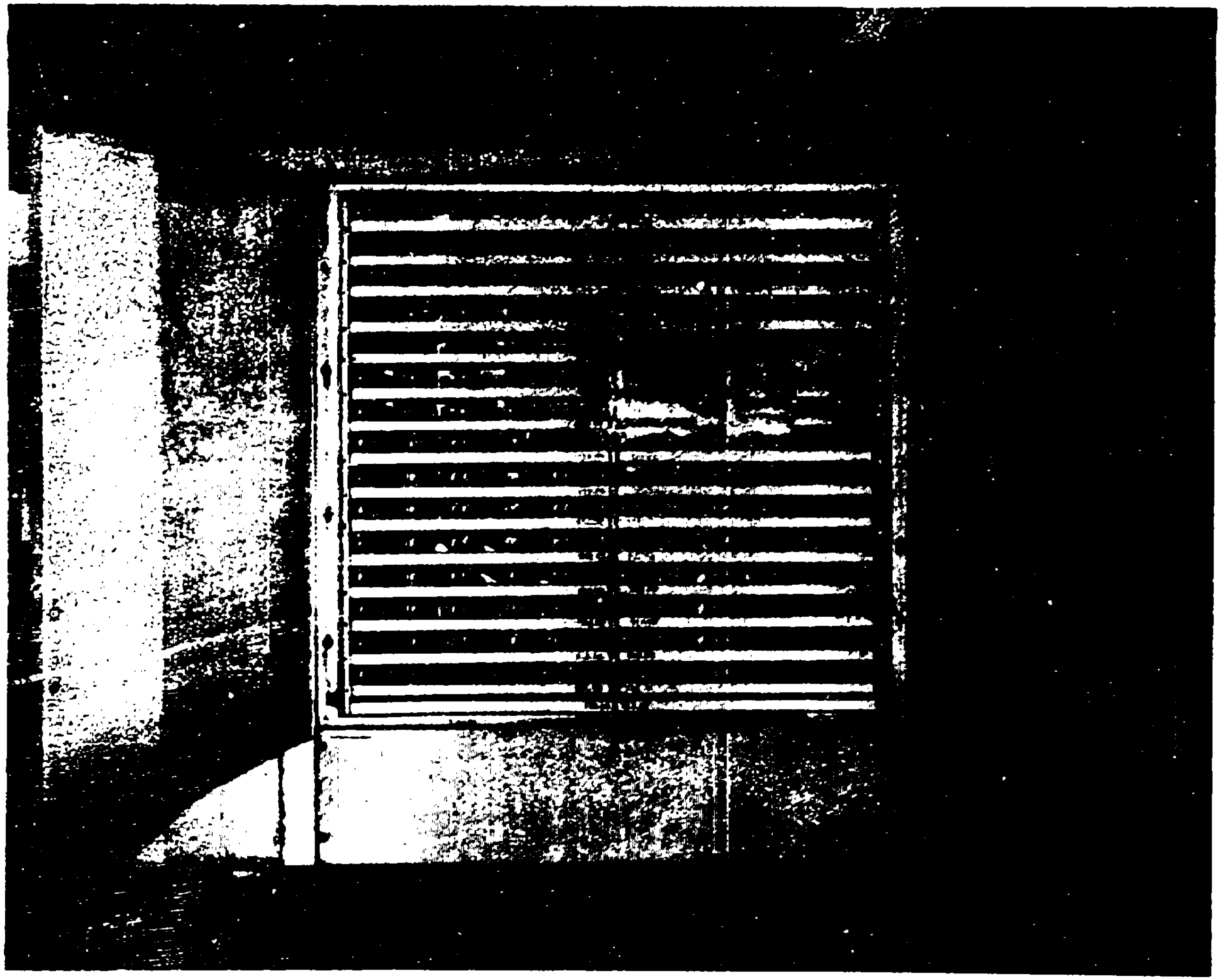
The specially prepared ovens for the 10,000 hour test of the First Production Lot of capacitors consisted of three (3) thermostatically controlled chambers (see Figure 13). Each oven chamber held thirty (30) metal racks (see Figure 14). Each rack held mounting clips to accomodate one-hundred thirty-five (135) capacitors (see Figure 15). On the back of each rack was mounted two (2) one-hundred and four (104) pin connectors (see Figure 15). The mating portion of each connector was mounted on the back wall of the oven chamber in such a position as to properly mate with the rack mounted portion of the connectors when the rack was positioned into the side slides provided (see Figure 14). A common connection was carried in the rack frame



One of the 3 thermostatically controlled oven chambers for 125°C 10,000 hour test

Test Oven

Figure 13



One of the 3 ovens, with 3 racks removed to show side slides and oven mounted portion of the 104 pin connectors

Test Oven, Racks Mounted

Figure 14

Back view of 2 of the capacitor test racks showing the mounting of the capacitors and the 2 connectors per rack

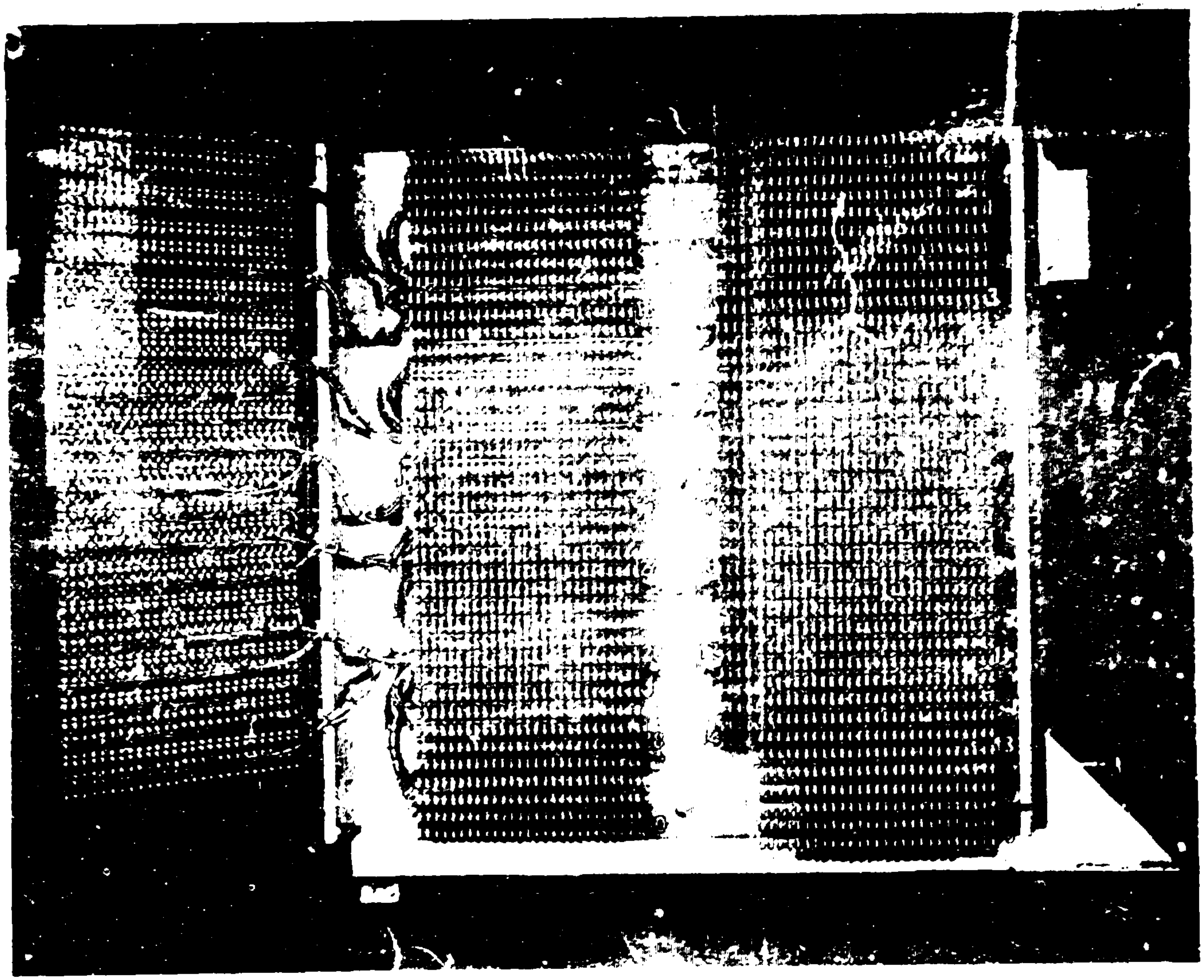
Capacitor Test Racks

Figure 15

for one side of each capacitor. The other terminal of each capacitor was connected to a pin of the connector via interconnecting leads. Each terminal of the oven wall mounted portion of the connector corresponding to a used terminal of the rack mounted portion of the connector was connected to either a 4700 or 5000 ohm resistor the opposite end of which was in turn connected to the required power supply. The resistors were mounted on hinged racks on the outside back of the oven. The racks were so designed that when swung out in the fashion of a hinged door each of the series resistors could be inspected visually or checked with an ohmeter to verify its condition (see Figure 16).

3.8.4 Test Inspection

During periodic inspections, at 250, 2000, 4000, 6000, and 8000 hours, 50 pieces of each capacitor rating were chosen at random and monitored for continued parametric conformance to the specification limits. At the 1000 and 10,000 hour inspection periods, all capacitance values were measured and recorded. Table XXIII is a histogram recording of the capacity values measured at 1000 hours and Table XXIV is a histogram recording of the capacity values measured at 10,000 hours. The computer program developed the Delta C histogram for each period displayed as Table XXV for 1000 hours and Table XXVI for 10,000 hours. All delta values were determined to be within the 10% limit (see 3.8.2.1).



4700/5000 Ohm series resistors mounted on hinged panels at back of oven

Series Resistor Panels

Figure 16

TABLE XXIII

CAPACITIES

SCS-301B104K 1000 HOURS

```
NO OF DATA POINTS    1925  MINIMUM      0.0918  #    21  MAXIMUM      0.1102  #  199    MEDIAN      0.1018
   MEAN VALUE     0.1015    STANDARD DEVIATION     0.0029
  FROM    TO    COUNT
   0.091    0.092    1
   0.092    0.093    4  .X
   0.093    0.094    9  .XXX
   0.094    0.095   22  .XXXXXXXX
   0.095    0.096   33  .XXXXXXXXXXXX
   0.096    0.097   81  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.097    0.098   98  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.098    0.099  140  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.099    0.100  174  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.100    0.101  223  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.101    0.102  262  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.102    0.103  268  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.103    0.104  218  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.104    0.105  178  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.105    0.106  110  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.106    0.107   60  .XXXXXXXXXXXXXXXXXXXXXX
   0.107    0.108   32  .XXXXXXXXXXX
   0.108    0.109    7  .XX
   0.109    0.110    4  .X
   0.110    0.111    1
```

TABLE XXIII

CAPACITIES

SCS-301B105K 1000 HOURS

NR OF DATA POINTS 1925 MINIMUM 0.9377 # 1487 MAXIMUM 1.1039 # 1431 MEDIAN 1.0518

MEAN VALUE 1.0405 STANDARD DEVIATION 0.0757

FROM	TO	COUNT	
0.930	0.940	1	
0.940	0.950	0	
0.950	0.960	[illegible]	
0.960	0.970	9	.XX
0.970	0.980	9	.XX
0.980	0.990	2[illegible]	.XXXXXX
0.990	1.000	28	.XXXXXXX
1.000	1.010	36	.XXXXXXXXX
1.010	1.020	84	.XXXXXXXXXXXXXXXXXXXXX
1.020	1.030	153	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.030	1.040	229	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.040	1.050	319	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.050	1.060	364	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.060	1.070	308	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.070	1.080	204	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.080	1.090	117	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.090	1.100	35	.XXXXXXXXX
1.100	1.110	3	

TABLE XXIII

CAPACITIES

SCS-301B405K 1000 HOURS

NO OF DATA POINTS 1925 MINIMUM 3.8030 # 484 MAXIMUM 4.4020 # 446 MEDIAN 4.0950
MEAN VALUE 4.0945 STANDARD DEVIATION 0.1177

FROM	TO	COUNT	
3.800	3.820	1	
3.820	3.840	1	
3.840	3.860	6	.XXX
3.860	3.880	10	.XXXXX
3.880	3.900	10	.XXXXX
3.900	3.920	14	.XXXXXXX
3.920	3.940	23	.XXXXXXXXXXX
3.940	3.960	50	.XXXXXXXXXXXXXXXXXXXXXXXXX
3.960	3.980	53	.XXXXXXXXXXXXXXXXXXXXXXXXXX
3.980	4.000	35	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.000	4.020	91	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.020	4.040	142	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.040	4.060	165	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.060	4.080	160	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.080	4.100	191	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.100	4.120	178	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.120	4.140	185	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.140	4.160	143	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.160	4.180	120	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.180	4.200	87	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.200	4.220	59	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.220	4.240	52	.XXXXXXXXXXXXXXXXXXXXXXXXXX
4.240	4.260	23	.XXXXXXXXXXX
4.260	4.280	32	.XXXXXXXXXXXXXXXX
4.280	4.300	16	.XXXXXXXX
4.300	4.320	10	.XXXXX
4.320	4.340	5	.XX
4.340	4.360	5	.XX
4.360	4.380	3	.X
4.380	4.400	2	.X
4.400	4.420	1	

TABLE XXIII

CAPACITIES

SCS-301C473K   1000 HOURS

```
NO OF DATA POINTS     1925  MINIMUM       0.0428  #  1729  MAXIMUM      0.0505  # 1406   MEDIAN      0.0468
  MEAN VALUE      0.0468     STANDARD DEVIATION       0.0014
   FROM    TO     COUNT
    0.043    0.043    1
    0.043    0.043    4   .XX
    0.043    0.044    4   .XX
    0.044    0.044    7   .XXX
    0.044    0.044   18   .XXXXXXXXX
    0.044    0.044   16   .XXXXXXXX
    0.044    0.045   41   .XXXXXXXXXXXXXXXXXXXX
    0.045    0.045   36   .XXXXXXXXXXXXXXXXXX
    0.045    0.045   65   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.045    0.045   55   .XXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.045    0.046  104   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.045    0.046   62   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.046    0.046  121   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.046    0.046   95   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.046    0.047  161   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.047    0.047  109   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.047    0.047  187   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.047    0.047  107   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.047    0.048  157   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.048    0.048   94   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.048    0.048  116   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.048    0.048   72   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.048    0.049   87   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.049    0.049   47   .XXXXXXXXXXXXXXXXXXXXXXX
    0.049    0.049   62   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.049    0.049   35   .XXXXXXXXXXXXXXXXX
    0.049    0.050   28   .XXXXXXXXXXXXXX
    0.050    0.050   18   .XXXXXXXXX
    0.050    0.050    9   .XXXX
    0.050    0.050    5   .XX
    0.050    0.051    2   .X
```

TABLE XXIII

CAPACITIES

SCS-301C334K 1000 HOURS

NO OF DATA POINTS 1925 MINIMUM 0.2963 # 811 MAXIMUM 0.3670 # 27 MEDIAN 0.3285

MEAN VALUE 0.3284 STANDARD DEVIATION 0.0137

FROM	TO	COUNT
0.295	0.298	1
0.298	0.300	5
0.300	0.303	13
0.303	0.305	27
0.305	0.308	38
0.308	0.310	47
0.310	0.313	58
0.313	0.315	80
0.315	0.318	91
0.318	0.320	127
0.320	0.323	133
0.323	0.325	138
0.325	0.328	153
0.328	0.330	143
0.330	0.333	140
0.333	0.335	155
0.335	0.338	127
0.338	0.340	130
0.340	0.343	86
0.343	0.345	58
0.345	0.348	61
0.348	0.350	41
0.350	0.353	31
0.353	0.355	30
0.355	0.358	9
0.358	0.360	1
0.360	0.363	2

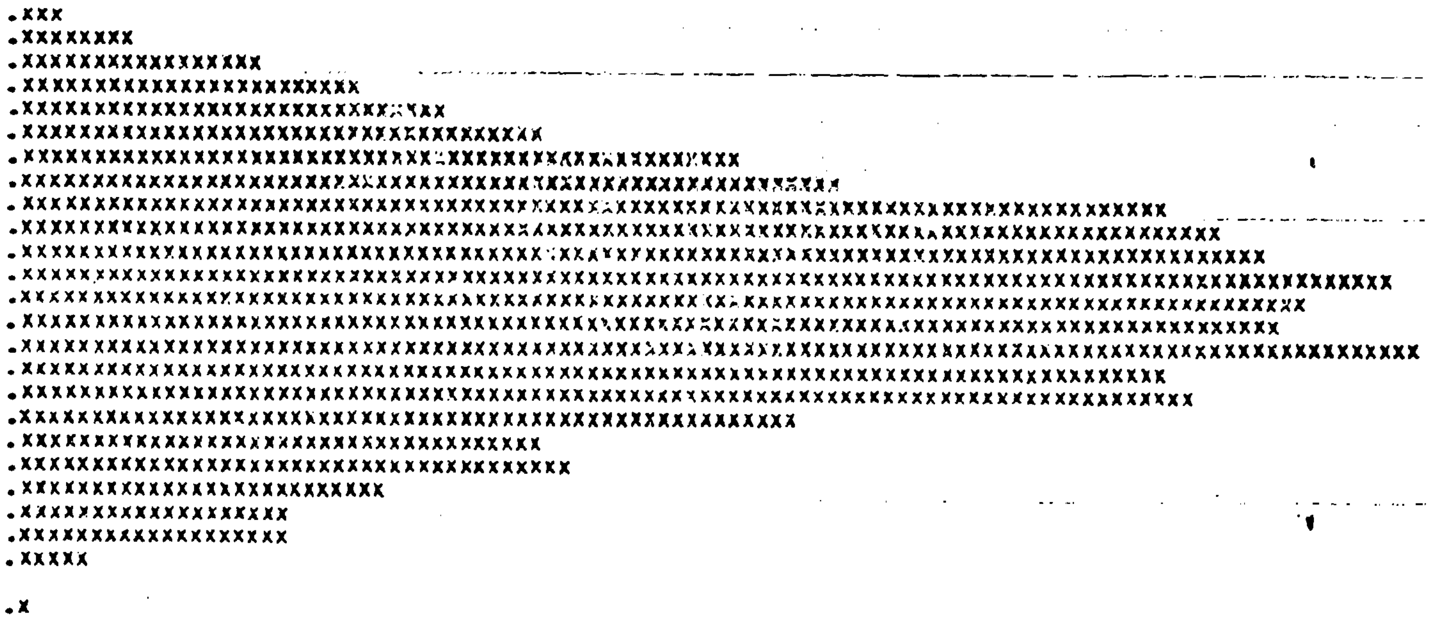


TABLE XXIII

CAPACITIES

SCS-C105K 1000 HOURS

```
NO OF DATA POINTS    1925  MINIMUM      0.9003  #   687  MAXIMUM     1.0880  #  195   MEDIAN     0.9660
  MEAN VALUE       0.9648   STANDARD DEVIATION      0.0216
   FROM    TO     COUNT
   0.900   0.910      2
   0.910   0.920     19  .XXXX
   0.920   0.930     72  .XXXXXXXXXXXXXXX
   0.930   0.940    129  .XXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.940   0.950    189  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.950   0.960    299  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.960   0.970    428  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.970   0.980    364  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.980   0.990    274  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.990   1.000    115  .XXXXXXXXXXXXXXXXXXXXXXXX
   1.000   1.010     26  .XXXXX
   1.010   1.020      4
   1.020   1.030      0
   1.030   1.040      0
   1.040   1.050      1
   1.050   1.060      1
   1.060   1.070      1
   1.070   1.080      0
   1.080   1.090      1
```

TABLE XXIV

CAPACITIES

SCS-301B104K 10, 000 HOURS

```
NO OF DATA POINTS    1925  MINIMUM    0.0909  #   21  MAXIMUM    0.1112  #  199   MEDIAN    0.1018
  MEAN VALUE       0.1016   STANDARD DEVIATION     0.0030
```

FROM	TO	COUNT
0.090	0.091	1
0.091	0.092	1
0.092	0.093	6
0.093	0.094	10
0.094	0.095	23
0.095	0.096	43
0.096	0.097	70
0.097	0.098	100
0.098	0.099	144
0.099	0.100	169
0.100	0.101	249
0.101	0.102	239
0.102	0.103	268
0.103	0.104	194
0.104	0.105	176
0.105	0.106	104
0.106	0.107	78
0.107	0.108	28
0.108	0.109	11
0.109	0.110	6
0.110	0.111	3
0.111	0.112	2

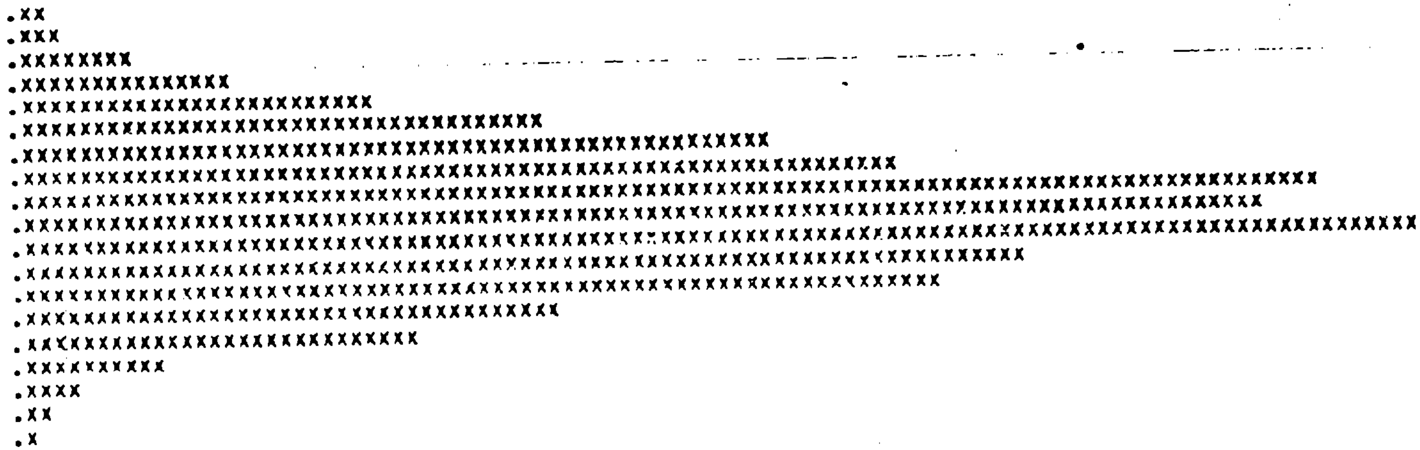


TABLE XXIV

CAPACITIES

SCS-301B105K 10,000 HOURS

D OF DATA POINTS 1925 MINIMUM 0.9581 # 1487 MAXIMUM 1.1260 # 1375 MEDIAN 1.0631
MEAN VALUE 1.0615 STANDARD DEVIATION 0.0281

FROM	TO	COUNT
0.950	0.960	1
0.960	0.970	2
0.970	0.980	9
0.980	0.990	15
0.990	1.000	24
1.000	1.010	27
1.010	1.020	45
1.020	1.030	100
1.030	1.040	145
1.040	1.050	228
1.050	1.060	310
1.060	1.070	304
1.070	1.080	262
1.080	1.090	226
1.090	1.100	140
1.100	1.110	61
1.110	1.120	23
1.120	1.130	3

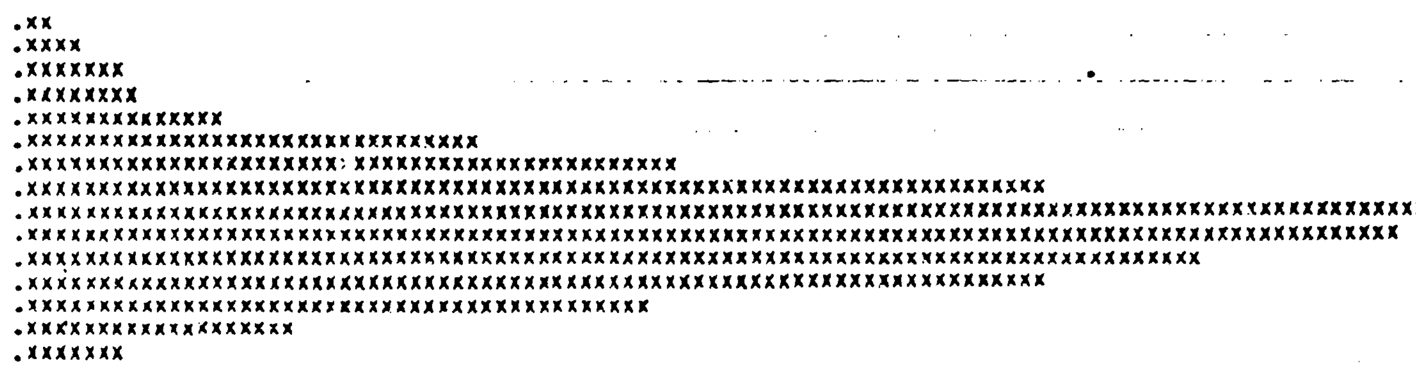


TABLE XXIV

CAPACITIES

SCS-301B405K 10, 000 HOURS

```
NO OF DATA POINTS     1925  MINIMUM         3.8290  #   484  MAXIMUM          4.4750  #  359    MEDIAN        4.1330
  MEAN VALUE        4.1335   STANDARD DEVIATION      0.1265
   FROM     TO     COUNT
    3.825     3.850     2
    3.850     3.875     3
    3.875     3.900    14   .XXX
    3.900     3.925     2
    3.925     3.950    29   .XXXXXXXX
    3.950     3.975    20   .XXXXX
    3.975     4.000   111   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    4.000     4.025    32   .XXXXXXXX
    4.025     4.050   162   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    4.050     4.075   100   .XXXXXXXXXXXXXXXXXXXXXXXXXXXX
    4.075     4.100   346   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    4.100     4.125    35   .XXXXXXXXX
    4.125     4.150   284   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    4.150     4.175   119   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    4.175     4.200   278   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    4.200     4.225    36   .XXXXXXXXXX
    4.225     4.250   143   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    4.250     4.275    41   .XXXXXXXXXXX
    4.275     4.300    92   .XXXXXXXXXXXXXXXXXXXXXXXXX
    4.300     4.325     9   .XX
    4.325     4.350    37   .XXXXXXXXXX
    4.350     4.375     5   .X
    4.375     4.400    16   .XXXX
    4.400     4.425     1
    4.425     4.450     5   .X
    4.450     4.475     2
    4.475     4.500     1
```

TABLF XXIV

CAPACITIES

SCS-301C473K 10,000 HOURS

```
NO OF DATA POINTS    1925  MINIMUM       0.0423  #   330  MAXIMUM   0.0517  # 1406   MEDIAN    0.0473
 MEAN VALUE       0.0472   STANDARD DEVIATION     0.0015
  FROM    TO     COUNT
   0.042   0.043     1
   0.043   0.043     2
   0.043   0.044     3
   0.044   0.044    10  .XXX
   0.044   0.045    27  .XXXXXXXX
   0.045   0.045    86  .XXXXXXXXXXXXXXXXXXXXXXXXXX
   0.045   0.046   103  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.046   0.046   210  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.046   0.047   168  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.047   0.047   292  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.047   0.048   216  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.048   0.048   313  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.048   0.049   133  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.049   0.049   185  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.049   0.050    79  .XXXXXXXXXXXXXXXXXXXXXXX
   0.050   0.050    67  .XXXXXXXXXXXXXXXXXXXX
   0.050   0.051    19  .XXXXX
   0.051   0.051    12  .XXX
   0.051   0.052     0
   0.052   0.052     1
```

TABLE XXIV

CAPACITIES

SCS-301C334K 10,000 HOURS

```
 OF DATA POINTS     1925  MINIMUM      0.2993  #   777  MAXIMUM      0.3683  #   27   MEDIAN      0.3321
MEAN VALUE      0.3317    STANDARD DEVIATION     0.0142
  FROM    TO      COUNT
   0.298   0.300     1
   0.300   0.303     1
   0.303   0.305    26   .XXXXXXXXXXX
   0.305   0.308    16   .XXXXXXX
   0.308   0.310    63   .XXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.310   0.313    20   .XXXXXXXXX
   0.313   0.315    90   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.315   0.318    40   .XXXXXXXXXXXXXXXXXX
   0.318   0.320   136   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.320   0.323    47   .XXXXXXXXXXXXXXXXXXXXX
   0.323   0.325   182   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.325   0.328    95   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.328   0.330   215   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.330   0.333    56   .XXXXXXXXXXXXXXXXXXXXXXXXX
   0.333   0.335   186   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.335   0.338    83   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.338   0.340   210   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.340   0.343    42   .XXXXXXXXXXXXXXXXXXX
   0.343   0.345   141   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.345   0.348    44   .XXXXXXXXXXXXXXXXXXXX
   0.348   0.350   102   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.350   0.353    15   .XXXXXX
   0.353   0.355    53   .XXXXXXXXXXXXXXXXXXXXXXXX
   0.355   0.353    13   .XXXXX
   0.358   0.360    39   .XXXXXXXXXXXXXXXXX
   0.360   0.363     2
   0.363   0.365     4   .X
   0.365   0.368     1
   0.368   0.370     2
```

TABLE XXIV

CAPACITIES

SCS-301C105K 10,000 HOURS

```
 OF DATA POINTS    1925  MINIMUM        0.8991  #   687  MAXIMUM      1.0895  #  195   MEDIAN      0.9699
MEAN VALUE       0.9702   STANDARD DEVIATION       0.0233
 FROM    TO      COUNT
  0.890        0.900     1
  0.900        0.910     1
  0.910        0.920    21   .XXXXX
  0.920        0.930    50   .XXXXXXXXXXXXXX
  0.930        0.940   108   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  0.940        0.950   165   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  0.950        0.960   290   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  0.960        0.970   341   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  0.970        0.980   356   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  0.980        0.990   286   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  0.990        1.000   176   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  1.000        1.010   104   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  1.010        1.020    20   .XXXXX
  1.020        1.030     2
  1.030        1.040     0
  1.040        1.050     0
  1.050        1.060     0
  1.060        1.070     2
  1.070        1.080     1
  1.080        1.090     1
```

TABLE XXV

DELTA CAPACITIES

SCS-301B104K 1000 HOURS

```
NO OF DATA POINTS     1925  MINIMUM      0.0000  #    19  MAXIMUM     0.0012  # 1462    MEDIAN      0.0003
 MEAN VALUE       0.0003    STANDARD DEVIATION      0.0002
  FROM    TO     COUNT
   0.000      0.000   165   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.000      0.000   383   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.000      0.000     0
   0.000      0.000   359   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.000      0.000     0
   0.000      0.000   342   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.000      0.000     0
   0.000      0.000   218   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.000      0.000     0
   0.000      0.001   187   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.001      0.001     0
   0.001      0.001   126   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.001      0.001     0
   0.001      0.001    59   .XXXXXXXXXXXXXXX
   0.001      0.001     0
   0.001      0.001    33   .XXXXXXXX
   0.001      0.001     0
   0.001      0.001    26   .XXXXXX
   0.001      0.001     0
   0.001      0.001    18   .XXXX
   0.001      0.001     0
   0.001      0.001     6   .X
   0.001      0.001     0
   0.001      0.001     3
```

TABLE XXV

DELTA CAPACITIES

SCS-301B105K   1000 HOURS

NO OF DATA POINTS 1925 MINIMUM 0.0000 # 13 MAXIMUM 0.0221 # 472 MEDIAN 0.0015
MEAN VALUE 0.0022 STANDARD DEVIATION 0.0022

FROM	TO	COUNT	
0.000	0.001	723	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.002	469	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.002	0.003	282	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.003	0.004	160	.XXXXXXXXXXXXXXXXXXXX
0.004	0.005	104	.XXXXXXXXXXXXX
0.005	0.006	61	.XXXXXXX
0.006	0.007	50	.XXXXXX
0.007	0.008	26	.XXX
0.008	0.009	16	.XX
0.009	0.010	10	.X
0.010	0.011	13	.X
0.011	0.012	4	
0.012	0.013	2	
0.013	0.014	3	
0.014	0.015	0	
0.015	0.016	1	
0.016	0.017	0	
0.017	0.018	0	
0.018	0.019	0	
0.019	0.020	0	
0.020	0.021	0	
0.021	0.022	0	
0.022	0.023	1	

TABLE XXV

DELTA CAPACITIES

SCS-301B405K 1000 HOURS

```
NO OF DATA POINTS     1925  MINIMUM         0.0000  #   177  MAXIMUM     0.0810  #   23    MEDIAN      0.0100
  MEAN VALUE        0.0134   STANDARD DEVIATION      0.0116
   FROM    TO      COUNT
    0.000      0.005   484   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.005      0.010   483   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.010      0.015   400   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.015      0.020   201   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.020      0.025   105   .XXXXXXXXXXXXXXXXXXXXX
    0.025      0.030    78   .XXXXXXXXXXXXXXX
    0.030      0.035    51   .XXXXXXXXXX
    0.035      0.040    46   .XXXXXXXXX
    0.040      0.045    30   .XXXXXX
    0.045      0.050    19   .XXX
    0.050      0.055     9   .X
    0.055      0.060    10   .XX
    0.060      0.065     4
    0.065      0.070     2
    0.070      0.075     2
    0.075      0.080     0
    0.080      0.085     1
```

TABLE XXV

DELTA CAPACITIES

SCS-301C473K 1000 HOURS

```
NO OF DATA POINTS    1925  MINIMUM      0.0000  #    3  MAXIMUM      0.0007  #  097   MEDIAN     0.0001
 MEAN VALUE       0.0001   STANDARD DEVIATION     0.0001
  FROM    TO      COUNT
   0.000      0.000  577   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.000      0.000    0
   0.000      0.000    0
   0.000      0.000  946   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.000      0.000    0
   0.000      0.000    0
   0.000      0.000    0
   0.000      0.000  303   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.000      0.000    0
   0.000      0.000    0
   0.000      0.000    0
   0.000      0.000   76   .XXXXXXX
   0.000      0.000    0
   0.000      0.000    0
   0.000      0.000    0
   0.000      0.000   20   .XX
   0.000      0.000    0
   0.000      0.000    0
   0.000      0.000    0
   0.000      0.001    2
   0.001      0.001    0
   0.001      0.001    0
   0.001      0.001    0
   0.001      0.001    0
   0.001      0.001    0
   0.001      0.001    0
   0.001      0.001    0
   0.001      0.001    0
   0.001      0.001    1
```

TABLE XXV

DELTA CAPACITIES

SCS-301C334K 1000 HOURS

# OF DATA POINTS	1925	MINIMUM	0.0000	# 59	MAXIMUM	0.0269	# 879	MEDIAN	0.0010
MEAN VALUE	0.0013	STANDARD DEVIATION	0.0014						

FROM	TO	COUNT	
0.000	0.001	1001	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.002	541	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.002	0.003	293	.XXXXXXXXXXXXXXXXXXXXXXXXXXX
0.003	0.004	77	.XXXXXX
0.004	0.005	7	
0.005	0.006	0	
0.006	0.007	1	
0.007	0.008	0	
0.008	0.009	0	
0.009	0.010	1	
0.010	0.011	0	
0.011	0.012	0	
0.012	0.013	0	
0.013	0.014	0	
0.014	0.015	0	
0.015	0.016	0	
0.016	0.017	0	
0.017	0.018	1	
0.018	0.019	0	
0.019	0.020	0	
0.020	0.021	0	
0.021	0.022	0	
0.022	0.023	1	
0.023	0.024	0	
0.024	0.025	0	
0.025	0.026	1	
0.026	0.027	1	

TABLE XXV

DELTA CAPACITIES

SCS-301C105K 1000 HOURS

```
NO OF DATA POINTS    1925  MINIMUM      0.0000  #   124  MAXIMUM      0.0099  #  702   MEDIAN      0.0024
  MEAN VALUE       0.0025    STANDARD DEVIATION      0.0015
   FROM    TO      COUNT
    0.000     0.001   171   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.001     0.001   176   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.001     0.002   227   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.002     0.002   236   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.002     0.003   253   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.003     0.003   203   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.003     0.004   205   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.004     0.004   163   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.004     0.005   103   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.005     0.005    79   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.005     0.006    57   .XXXXXXXXXXXXXXXXXXXXXX
    0.006     0.006    24   .XXXXXXXXX
    0.006     0.007    10   .XXX
    0.007     0.007    12   .XXXX
    0.007     0.008     3   .X
    0.008     0.008     0
    0.008     0.009     0
    0.009     0.009     1
    0.009     0.010     0
    0.010     0.010     2
```

TABLE XXVI

DELTA CAPACITIES

SCS-301B104K　　　　10,000 HOURS

NO OF DATA POINTS 1925 MINIMUM 0.0000 # 42 MAXIMUM 0.0055 # 1920 MEDIAN 0.0005
MEAN VALUE 0.0006 STANDARD DEVIATION 0.0005

FROM	TO	COUNT	
0.000	0.000	518	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.000	0.000	350	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.000	0.001	308	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.001	226	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.001	183	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.001	113	.XXXXXXXXXXXXXXXXXXXXX
0.001	0.001	80	.XXXXXXXXXXXXXXX
0.001	0.002	56	.XXXXXXXXXX
0.002	0.002	32	.XXXXXX
0.002	0.002	27	.XXXXX
0.002	0.002	10	.X
0.002	0.002	7	.X
0.002	0.003	2	
0.003	0.003	2	
0.003	0.003	3	
0.003	0.003	2	
0.003	0.003	1	
0.003	0.004	3	
0.004	0.004	1	
0.004	0.004	0	
0.004	0.004	0	
0.004	0.004	0	
0.004	0.005	0	
0.005	0.005	0	
0.005	0.005	0	
0.005	0.005	0	
0.005	0.005	0	
0.005	0.006	1	

TABLE XXVI

DELTA CAPACITIES

```
         SCS-301B105K                    10,000 HOURS
NO OF DATA POINTS     1925  MINIMUM       0.0000  #   664  MAXIMUM      0.0510  #  677    MEDIAN      0.0095
  MEAN VALUE      0.0133    STANDARD DEVIATION      0.0108
   FROM     TO       COUNT
     0.000       0.002   271   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
     0.002       0.004   259   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
     0.004       0.006   214   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
     0.006       0.008   139   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
     0.008       0.010    98   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
     0.010       0.012    70   .XXXXXXXXXXXXXXXXXXXXXXX
     0.012       0.014    46   .XXXXXXXXXXXXXXX
     0.014       0.016    51   .XXXXXXXXXXXXXXXXX
     0.016       0.018    73   .XXXXXXXXXXXXXXXXXXXXXXXX
     0.018       0.020    64   .XXXXXXXXXXXXXXXXXXXXX
     0.020       0.022   110   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
     0.022       0.024   106   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
     0.024       0.026   117   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
     0.026       0.028    96   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
     0.028       0.030    75   .XXXXXXXXXXXXXXXXXXXXXXXXX
     0.030       0.032    67   .XXXXXXXXXXXXXXXXXXXXXX
     0.032       0.034    27   .XXXXXXXXX
     0.034       0.036    21   .XXXXXXX
     0.036       0.038     6   .XX
     0.038       0.040     7   .XX
     0.040       0.042     4   .X
     0.042       0.044     1
     0.044       0.046     0
     0.046       0.048     2
     0.048       0.050     0
     0.050       0.052     1
```

TABLE XXVI

DELTA CAPACITIES

SCS-301B405K 10,000 HOURS

```
NO OF DATA POINTS    1925  MINIMUM      0.0000  #   252  MAXIMUM      0.1820  #  418    MEDIAN      0.0320
  MEAN VALUE       0.0456   STANDARD DEVIATION      0.0389
   FROM    TO    COUNT
    0.000     0.010  365   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.010     0.020  339   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.020     0.030  228   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.030     0.040  180   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.040     0.050  122   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.050     0.060   96   .XXXXXXXXXXXXXXXXXXXXXXXXXX
    0.060     0.070   80   .XXXXXXXXXXXXXXXXXXXXX
    0.070     0.080   85   .XXXXXXXXXXXXXXXXXXXXXXX
    0.080     0.090   90   .XXXXXXXXXXXXXXXXXXXXXXXX
    0.090     0.100  102   .XXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.100     0.110   78   .XXXXXXXXXXXXXXXXXXXXX
    0.110     0.120   61   .XXXXXXXXXXXXXXXX
    0.120     0.130   49   .XXXXXXXXXXXXX
    0.130     0.140   23   .XXXXXX
    0.140     0.150   15   .XXXX
    0.150     0.160    6   .X
    0.160     0.170    4   .X
    0.170     0.180    1
    0.180     0.190    1
```

TABLE XXVI

DELTA CAPACITIES

SCS-301C473K 10,000 HOURS

NO OF DATA POINTS 1925 MINIMUM 0.0000 # 3 MAXIMUM 0.0045 # 855 MEDIAN 0.0003
MEAN VALUE 0.0004 STANDARD DEVIATION 0.0004

FROM	TO	COUNT	
0.000	0.000	874	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.000	0.000	232	.XXXXXXXXXXXXXXXXXXXXXXXX
0.000	0.001	225	.XXXXXXXXXXXXXXXXXXXXXXX
0.001	0.001	289	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.001	220	.XXXXXXXXXXXXXXXXXXXXXXX
0.001	0.001	71	.XXXXXXX
0.001	0.001	9	
0.001	0.002	0	
0.002	0.002	1	
0.002	0.002	0	
0.002	0.002	0	
0.002	0.002	0	
0.002	0.003	0	
0.003	0.003	0	
0.003	0.003	2	
0.003	0.003	0	
0.003	0.003	0	
0.003	0.004	0	
0.004	0.004	0	
0.004	0.004	0	
0.004	0.004	1	
0.004	0.004	0	
0.004	0.005	1	

TABLE XXVI

DELTA CAPACITIES

SCS-301C334K 10,000 HOURS

```
NO OF DATA POINTS    1925  MINIMUM        0.0000  #   84  MAXIMUM    0.0225  #  381   MEDIAN     0.0038
  MEAN VALUE      0.0043   STANDARD DEVIATICN      0.0032
   FROM    TO    COUNT
    0.000   0.001  403  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.001   0.002  268  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.002   0.003  193  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.003   0.004  130  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.004   0.005   94  .XXXXXXXXXXXXXXXXXXXXXXX
    0.005   0.006  149  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.006   0.007  163  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.007   0.008  205  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.008   0.009  189  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.009   0.010   95  .XXXXXXXXXXXXXXXXXXXXXXX
    0.010   0.011   26  .XXXXXX
    0.011   0.012    2
    0.012   0.013    1
    0.013   0.014    1
    0.014   0.015    0
    0.015   0.016    0
    0.016   0.017    0
    0.017   0.018    2
    0.018   0.019    1
    0.019   0.020    0
    0.020   0.021    0
    0.021   0.022    0
    0.022   0.023    2
```

TABLE XXVI

DELTA CAPACITIES

SCS-301C105K 10,000 HOURS

```
 OF DATA POINTS    1925  MINIMUM      0.0000  #    14  MAXIMUM     0.0561  # 1136   MEDIAN     0.0034
MEAN VALUE     0.0066    STANDARD DEVIATICN     0.0068
  FROM    TO     COUNT
  0.000    0.002   654   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  0.002    0.004   427   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  0.004    0.006   174   .XXXXXXXXXXXXXXXXXXXXXXXXXX
  0.006    0.008    75   .XXXXXXXXXXX
  0.008    0.010    51   .XXXXXXX
  0.010    0.012    58   .XXXXXXXX
  0.012    0.014    87   .XXXXXXXXXXXXX
  0.014    0.016   100   .XXXXXXXXXXXXXXX
  0.016    0.018   127   .XXXXXXXXXXXXXXXXXXX
  0.018    0.020    95   .XXXXXXXXXXXXXX
  0.020    0.022    50   .XXXXXXX
  0.022    0.024    21   .XXX
  0.024    0.026     3
  0.026    0.028     1
  0.028    0.030     0
  0.030    0.032     0
  0.032    0.034     0
  0.034    0.036     0
  0.036    0.038     0
  0.038    0.040     0
  0.040    0.042     0
  0.042    0.044     0
  0.044    0.046     0
  0.046    0.048     0
  0.048    0.050     0
  0.050    0.052     0
  0.052    0.054     0
  0.054    0.056     1
  0.056    0.058     1
```

3.8.4.1 Failure Rate for Polycarbonate Capacitors

Based on the test of 11,550 capacitors for 10,000 hours, the objective failure rate of .002% per 1K hours was achieved. The FR formula is:

$$FR = \left(\frac{(F + 1)\,10^5}{Hu}\right) \cdot \left(UC\right)$$

Where:

FR = % per 1K hours

F = Total number of failures

Hu = Total unit hours

UC = Max upper confidence limit factor.

The achieved failure rate evidences the capability of metallized polycarbonate film capacitors to achieve the S reliability level of the MIL-STD-690 at .001% per 1K hours at 90% confidence level when 23,000 units are tested for 10,000 hours at 125°C at rated voltage DC with 0 failures demonstrated.

3.8.5 Conclusions

The testing of the Metallized Polycarbonate Film Capacitors was considered completed with 0 failures at the end of the 10,000 hour period.

3.8.6 Maintenance of Test Facilities

At the conclusion of the 10,000 hour test, the three (3) ovens and test racks were inspected to determine the extent of repair

required to prepare the ovens for the second 10,000 hour test program to be performed with Metallized Polysulfone Capacitors. It was determined that a number of connectors and terminal clips showed excessive degradation as a result of the 10,000 hours on voltage and exposure to 125°C.

These degraded parts were replaced and the oven thermostats were inspected for wear. It was believed that the existing condition of the controls was satisfactory for continuation of use in the second test program, and the oven chambers in general appeared to be in satisfactory condition.

PART 2

THE METALLIZED POLYSULFONE FILM CAPACITOR

3.9 Phases 1 and 2 Process Improvement, Test and Evaluation

The conditions or processes evaluated are as follows:

(a) Quality of Metallized Polysulfone as Received

(b) Shrinkage of Film

(c) Heat Treatment of Capacitor Section

(d) Removal of Entrapped Solvent

(e) Burn-In.

3.9.1 Introduction

Polysulfone is a high temperature resin with thermal, chemical, and electrical properties that make it quite attractive as a capacitor dielectric material. Chemically, the polymer is a polyether with linkages that make the material highly resistant to hydrolysis and oxidation. The material is soluble in polar organic solvents, aromatic hydrocarbons, clorinated hydrocarbons, and ketones. The electrical properties of polysulfone are comparable to those for polycarbonate. The glass transition temperature is typically 190°C.

These properties suggest that polysulfone could replace and perhaps even improve upon polycarbonate as the film dielectric in a metallized capacitor. Since polysulfone is soluble in a variety of solvents, thin film could be made by the solvent casting as well as by the extrusion techniques. The relative chemical inertness along with the high temperature capabilities of polysulfone should combine to provide a dielectric with an inherently longer 125°C life expectancy since capacitor life is to a significant extent a function of the rate of chemical reactions within the dielectric system and of chemical degradation and dissociation.

The objective of the polysulfone portion of this Production Engineering Measure was a Metallized Polysulfone capacitor with a performance indicating a capability of 0.001% failure rate per 1000 hours at 90% confidence level when operated at rated voltage and 125°C; and an achievable FR of .002% for the 11,550 tested, for 10,000 hours with zero failures.

Table II lists the Phases for the Metallized Polysulfone evaluation and test program.

3.9.2 Quality of Film as Received - Phase 1

A comprehensive incoming inspection was performed on each roll of metallized polysulfone material received including measurements of width, thickness, margin, and metal thickness.

The 1/2" wide x 25 gauge and 1 3/4" wide x 50 gauge rolls were acceptable quality. The 1/2" x 50 gauge and the 1 3/4" x 25 gauge materials were rejected for thin metallization. The metal resistance was as high as 240% over the upper resistance limit for these rolls. All rejected material was returned to the domestic source for replacement. The replacement rolls of film were acceptable.

3.9.3 Polysulfone Film Shrinkage - Phase 1

Film shrinkage tests were performed at temperature ranging from 120° to 170°C in 10°C increments. Three inch lengths of 1 3/4" wide film of each thickness (25 gauge and 50 gauge) were suspended in a heated chamber for one hour at each temperature increment. No significant shrinkage was observed.

This result indicated that e conditions for heat treatment could be chosen to be within the shrinkage t temperature range and that insufficient or excessive shrinkage would not be a factor for concern.

3.9.4 Polysulfone Section Winding - Phase 1

A total of 600 metallized polysulfone capacitor sections were required for the process improvement evaluation phase as follows:

Part Number	Rating	No. Sections Proposed	Actual
SCS-301B104K	0.10 mfd - 100VDC	150	205
SCS-301B405K	4.0 mfd - 100VDC	150	181
SCS-301C473K	0.047 mfd - 200VDC	150	219
SCS-301C105K	1.0 mfd - 200VDC	150	136

The winding of the capacitor sections was completed with an average winding yield of 90%. The sections were inspected for physical dimensions, margin, variation, wrinkles, overall workmanship, and capacitance and were found to be satisfactory.

3.9.5 Heat Treatment of Sections - Phase 1

An effective section heat treatment could remove any moisture, entrapped solvent, and undesirable residuals as well as condition the capacitor section for mechanical and electrical stability. In order to perform the test matrix to determine the most effective heat treatment, at least 30 sections of each of the capacitor ratings wound for evaluation of process improvement were subjected to each of the following five heat treatments. A total of 775 units were tested.

(a) Group 1 (155 units): Heat for 12 hours at 150°C in air

(b) Group 2 (155 units): Heat for 24 hours at 150°C in air

(c) Group 3 (155 units): Heat for 24 hours at 125°C in air followed by 24 hours at 150°C in air

(d) Group 4 (155 units): Heat for 18 hours at 125°C under vacuum of less than 250 microns followed by 24 hours at 150°C in air

(e) Group 5 (155 units): Heat for 24 hours at 85°C in air followed by 24 hours at 125°C in air followed by 24 hours at 150°C at 150°C in air

3.9.6 Phases 1 and 2 - Electrical Test of Sections After Heat Treatment

After heat treatment, the polysulfone sections were tested for dielectric strength, capacitance, dissipation factor, and insulation resistance, all at 25°C. The test conditions and limits were as follows:

Dielectric Strength:	2x rated voltage
Capacitance:	±10% of nominal
Dissipation Factor:	0.30% maximum
Insulation Resistance:	500,000 megohms or 100,000 megohms x mfds minimum.

The section test results presented in Table XXVII showed an inordinately high number of 4 mfd - 100VDC sections with low insulation resistance. Since the tests were performed on uncased sections, the significance of this fact was questioned. The results did suggest that the quality of the metallized film used for the 4 mfd part was suspect.

3.9.7 Assembly

Those sections that failed the voltage test were discarded and the remainder of the parts that had received the heat treatment and section test were completely assembled. Precautions were taken during all of the steps comprising the assembly operation to assure that the

TABLE XXVII

PHASES 1 AND 2
METALLIZED POLYSULFONE SECTION TEST RESULTS

Heat Treatment	Type	Units Tested	Low IR	High DF	Cap. Failures	Voltage Test Failures
Group 1	SCS-301C473K	46	0	0	0	0
	SCS-301B104K	41	0	0	0	0
	SCS-301C105K	30	0	0	0	2
	SCS-301B405K	38	8	0	0	0
Group 2	SCS-301C473K	46	0	0	0	0
	SCS-301B104K	41	0	0	0	0
	SCS-301C105K	30	0	0	0	0
	SCS-301B405K	38	11	0	0	0
Group 3	SCS-301C473K	46	0	0	0	0
	SCS-301B104K	41	0	0	0	0
	SCS-301C105K	30	0	1	0	0
	SCS-301B405K	38	15	2	0	0
Group 4	SCS-301C473K	46	0	1	0	5
	SCS-301B104K	41	0	0	0	0
	SCS-301C105K	30	0	1	0	1
	SCS-301B405K	38	12	1	0	0
Group 5	SCS-301C473K	46	0	0	0	0
	SCS-301B104K	41	0	0	0	0
	SCS-301C105K	30	0	0	0	2
	SCS-301B405K	38	13	1	0	2

Note: These units were uncased capacitor sections only and were tested to finished capacitor requirements. The tests were performed at 25°C and are not intended to be indicative of final results.

metallized polysulfone parts were not subjected to contamination from external sources. Assembly proceeded as follows:

Metal solder was applied to the electrode ends of the capacitor section after which lead wires were attached. The next step in the assembly operation consisted of applying plastic insulating end caps to each end of the capacitor section. The capacitor section was then inserted into an electro-tinned brass tube. A compression glass header was threaded over the lead wire at each end of the capacitor section and was soldered to the case. The eyelet of one of the two compression glass headers was solder sealed. The next step in the operation consisted of filling the voids inside the assembly with a potting resin through the single remaining open eyelet.

The function of this potting resin was to provide shock and vibration resistance consistent with the requirements of MIL-C-39022. The one remaining open eyelet was solder sealed thus completing the operation. The entire lot of capacitors was given a 100% visual inspection and a seal test.

3.9.8 Production Burn-In - Phase 2

The burn-in adopted for the polysulfone capacitor portion of this Production Engineering Measure was identical to that adopted for the polycarbonate part, i.e., to subject the capacitors to 140% of rated voltage for 250 hours at 120°C.

The test capacitors were first subjected to pre burn-in dielectric strength test and electrical measurements. The rejects were removed and the remainder of the capacitors underwent the 250 hour production burn-in. Electrical measurements were again performed on the "burned in" parts. The criteria used to determine a failure were the requirements of MIL-C-39022 and SCS-301.

The results of the pre and post burn-in electrical measurements are summarized in Table XXVIII as a function of heat treatment. There were no catastrophic failures during burn-in. There were no dielectric strength or capacitance failures either before or after burn-in. The total number of 25°C insulation resistance failures amounted to 6.1% of the capacitors tested.

3.9.9 Group A and B Inspection - Phase 2

After burn-in the capacitors were subjected to Group A inspection in accordance with Table XII of MIL-C-39022. Since the parameter rejects were not removed after burn-in, those same failures were recorded in the Group A testing.

All rejects were removed and the remainder of the parts underwent Group B inspection in accordance with Table XIII of MIL-C-39022. The inspection limits were:

TABLE XXVIII

PHASES 1 AND 2
SUMMARY OF POLYSULFONE BURN-IN RESULTS

Heat Treatment	No. Units	Pre Burn-In Failures: Insulation Resistance	Pre Burn-In Failures: Dissipation Factor	Post Burn-In Results: Insulation Resistance	Post Burn-In Results: Dissipation Factor
Group 1	150	4	0	6	0
Group 2	150	3 3	0	8	6
Group 3	149	2	0	5	1
Group 4	142	3	0	10	1
Group 5	146	1	0	3	0

Limits:

Dielectric Strength: 2 x rated voltage
Capacitance: Nominal ±10%
Dissipation Factor: 0.30%
Insulation Resistance: 5×10^5 megohms or 1×10^5 megohms x mfds min.

Dielectric Strength:	2x rated voltage
Capacitance:	±10% of original value
Dissipation Factor:	
25°C	0.30% maximum
125°C	0.60% maximum
Insulation Resistance:	
125°C	2×10^3 megohms or 1×10^3 megohms x mfds minimum.

Table XXIX summarized the Group B inspection results. Only one catastrophic failure was recorded, and that from the heat treatment 5 group. The only group that exhibited zero failures was heat treatment 1.

3.9.10 Selection of Process Improvements

Heat treatment 1, the production burn-in, and subsequent electrical measurements combined to produce a capacitor lot completely free of rejects at Group B inspection testing. This indicated that all potential rejects were effectively screened from the lot prior to submission to lot acceptance testing. These process steps were made a part of the Metallized Polysulfone Capacitor Manufacturing Process.

Heat treatment 1 consisted of heating the capacitor sections for 12 hours at 150°C in air. The production burn-in conditions were 250 hours at 140% of rated voltage and 125°C.

The decision was made to proceed with the Phase 3 First Article tests using the modified process.

TABLE XXIX

PHASE 2
GROUP B INSPECTION OF METALLIZED POLYSULFONE CAPACITORS

Heat Treatment	Units Tested	+125°C IR Failures	+125°C DF Failures	Life Test Failures	Post Life Failures	Total Failures
Group 1	140	0	0	0	0	0
Group 2	133	0	3	0	1	4
Group 3	141	0	2	0	3	5
Group 4	128	1	1	0	7	9
Group 5	142	1	2	1	2	6

3.10 Phase 3 - First Article Tests

With the completion of the Evaluation and Process Improvement Phases, the Preproduction or First Article Test for Metallized Polysulfone Capacitors was undertaken. This involved the manufacture of 256 capacitors in accordance with the modified Manufacturing Process followed by subjecting these capacitors to the Qualification Inspection electrical, mechanical, and environmental tests as outlined in Table IX of MIL-C-39022 and modified by SCS-301. The 256 capacitors were comprised of the following:

Part Number	Rating	No. Units
SCS-301B104K	0.10 mfd - 100VDC	64
SCS-301B405K	4.0 mfd - 100VDC	64
SCS-301C473K	0.047 mfd - 200VDC	64
SCS-301C105K	1.0 mfd - 200VDC	64

Descriptions of each of the test procedures and the test results are included in sections 3.10.1 through 3.10.5.

3.10.1 Test Group I - 256 Units

VISUAL AND MECHANICAL EXAMINATION 4.6.1

All units were examined for type of materials, construction, physical dimensions, markings and external workmanship.

The units showed no evidence of damage and were properly marked. All dimensions were within the specified tolerances.

TEMPERATURE CYCLING 4.6.2

The capacitors were placed, from room temperature, into a chamber at -55°C +0 -3°C, and allowed to stabilize for a period of 30 minutes. They were removed from the low temperature chamber after the 30 minute period, allowed to set at room temperature for a period of time from 10 to 15 minutes, and then placed in a high temperature chamber at +125°C +3 -0°C, and allowed to stabilize for a 30 minute period. The capacitors were then removed from the high temperature chamber and allowed to set at ambient temperature for a period of time from 10 to 15 minutes. This series of transfers constituted one cycle. This cycle was repeated five times.

At the conclusion of the test, the capacitors were allowed to stabilize at 25°C. No measurements were made before or after the cycling.

No vidual evidence of damage was observed.

SEAL TEST 4.6.3

The capacitors, while at room temperature, were immersed for a period of one minute in mineral oil maintained at a temperature of 125°C -0 +5°C. The capacitors were examined during and after the test for evidence of leakage of the impregnant or filling compound.

No visual evidence of leakage was observed.

DIELECTRIC WITHSTANDING VOLTAGE 4.6.4

A DC potential equal to 200% of rated voltage was connected from terminal to terminal for a period of one minute. This same potential was then connected from the case to the terminals for a period of one minute. At the conclusion of this test, the capacitors were visually examined for evidence of damage.

There was no momentary or intermittent arcing or other indication of breakdown. Also, there was no visual evidence of damage at the conclusion of the test.

CAPACITANCE 4.6.5

The capacitors with values of 1.0μF and less were connected to a General Radio, Model 1608A, Impedance Bridge, operating at a frequency of 1000 Hz ± 100 Hz with a limiting accuracy equal to or less than 0.05%. An external frequency of 60 Hz was applied to this same bridge for measurement of the 4.0μF capacitors. The capacitance was measured while the capacitors were at room ambient temperature.

All values were found to be within 10% of their rated nominal values.

DISSIPATION FACTOR 4.6.6

The dissipation factor of each capacitor was measured concurrently with capacitance.

All units were below the .3% maximum dissipation factor limit.

INSULATION RESISTANCE 4.6.7

The insulation resistance of the capacitors was measured at the rated DC voltage, utilizing a Keithley Model 610B Electrometer in conjunction with a Power Designs Model 2K10 Regulated Power Supply. The resistance from terminal to terminal at 25°C, the resistance from terminal to case at 25°C and the resistance from terminal to terminal at 125°C was measured. At the conclusion of the 125°C insulation resistance measurement the capacitors were removed from the temperature chamber.

All values were greater than the specified minimum requirements.

FLASHOVER 4.6.8

The capacitors were mounted, by their leads, in the test chamber and the pressure was reduced to .82 inches of mercury (equivalent to 80,000 feet). After the pressure had stabilized, a DC potential equal to 125% of the rated voltage was applied for a period of one minute between terminals and between each terminal and the case. After the conclusion of the electrical test, the pressure was returned to ambient and the capacitors were removed from the test chamber and visually examined for evidence of damage.

There was no evidence of momentary or intermittent arcing or other indication of breakdown during the tests. Also, there was no visible evidence of damage at the conclusion of the test.

3.10.2 Test Group II - 24 Units

VIBRATION, HIGH FREQUENCY 4.6.9

The capacitors were encapsulated in a hard wax-like epoxy, the vibration transmissibility of which had previously been tested to 2000 Hz and found to be satisfactory. The capacitors were epoxied to 5" x 5" aluminum plates and the leads were supported by insulated solder terminals located approximately 1/2" from the seal end of the capacitors.

These plates were then forwarded to Continental Testing Laboratories, Inc. for vibration over the frequency range of 10-2000 Hz at an amplitude of .06" DA or 20 g's, whichever, was the lesser. The frequency was varied at a logarithmic rate such that it took twenty minutes to traverse the frequency range of 10-2000-10 Hz.

The vibration was performed in two mutually perpendicular axes for four hours in each of the radial and axial planes for a total of eight hours. Throughout the test, a potential of 50% of the rated DC voltage was applied between the terminals of the capacitors. During the last cycle in each axis, the capacitors were monitored for any electrical discontinuities or shorts.

No opens or shorts were detected during the test.

SALT SPRAY 4.6.10

The specimens were mounted in an Associated Testing Laboratories, Model SS-3-4, Salt Spray Chamber so that the longitudinal axis was approximately at a 15° angle from the vertical and parallel to the principle direction of horizontal flow of the fog through the chamber.

The chamber was programmed to operate at a temperature of 35°C +2 -3°F. A 20% salt solution was used to generate the fog and was applied for a period of 48 hours.

At the completion of the 48 hour period, the devices were removed from the chamber, and salt deposits were removed by washing them in running water at a temperature of less than 37.8°C. After a 24 hour drying period, the capacitors were visually examined for evidence of harmful corrosion and obliteration of markings.

At least 90% of all exposed metallic surfaces were protected by the finish and the markings remained legible.

IMMERSION 4.6.11

The capacitors were immersed for a period of one hour in a saturated solution of sodium chloride and water at a temperature of 65° +5 -0°C, followed by immersion in a bath consisting of a saturated

solution of sodium chloride and water at a temperature of 0° ±3°C for a period of one hour. This cycle was repeated five times.

At least four hours, and not more than twenty-four after the completion of the final cycle, the dielectric withstanding voltage and insulation resistance of the capacitor and the capacitor to its case was measured. Capacitance and dissipation factor were also measured at 25°C. The capacitors were then examined for harmful or extensive corrosion and obliteration of markings.

No discrepancies were noted.

3.10.3 Test Group III - 24 Units

SOLDERABILITY 4.6.12

Prior to the application of flux and solder, 50% of the capacitors were subjected to aging by immersion in a noncorrosive container of boiling, distilled water for a period of one hour. No aging was performed on the remaining capacitors.

The terminals of all the capacitors were then immersed in flux conforming to type W of specification MIL-F-14256 to within 1/8" of the capacitor body, at room ambient temperature, for a period of 5 to 10 seconds. The dross and burned flux was then skimmed from the surface of the molten solder. Following this the capacitor was installed in the capacitor dip machine and dipped into the solder at the

rate of 1 ± 1/4" per second, with a dwell time at the required depth of 5 ± 1/2 seconds and withdrawn at the rate of 1 ± 1/4" per second.

After the dipping process, the capacitor lead was allowed to cool in air and the process was performed on the other lead. The residue flux was removed from the terminations by dipping in isopropyl alcohol and cleaning with a soft cloth.

After the cleaning process, the surface of each lead was examined using a microscope with a 10 power magnification, for 95% coverage of a continuous new solder coat and checked that pinholes or voids were not concentrated in one area and did not exceed 5% of the total area.

The leads were found to be covered uniformly with a smooth bright film of solder, and there was no evidence of pinholes or concentration of voids in the solder coverage.

SHOCK, MEDIUM IMPACT 4.6.13

The capacitors were encapsulated in a hard wax-like epoxy, the transmissibility of which had previously been tested and found to be satisfactory. The encapsulated capacitors were attached to 5" x 5" aluminum plates and the leads were supported by insulated solder terminals located approximately 1/2" from the seal end of the capacitors.

These plates were then forwarded to Continental Testing Laboratories, Inc. for medium impact shock. The specimens were dropped a total of 18 times, 3 blows or 3 shocks in each of the 3 axes. The peak shock value indicated was 100 g's with a pulse duration of 6 ms. During the test, a DC potential equal to 50% of the rated voltage was applied between the terminals, and a time monitor (capable of detecting transients in excess of 0.5 msec) was connected to monitor the voltage across each capacitor in order to determine any electrical failures or indication of malfunctions during the shock test.

Following the application of the final shock, the capacitors were removed from the shock machine and visually examined for damage.

During the shock test there were no opens or shorts detected.

There was no evidence of fractures or other visible mechanical damage.

TEMPERATURE CYCLING 4.6.2

The capacitors were placed, from room temperature, into a chamber at -55°C +0 -3°C, and allowed to stabilize for a period of 30 minutes. They were removed from the low temperature chamber after the 30 minute period, allowed to set at room temperature for a period of time from 10 to 15 minutes, and then placed in a high

temperature chamber at +125°C +3 -0°C, and allowed to stabilize for a 30 minute period. The capacitors were then removed from the high temperature chamber and allowed to set at ambient temperature for a period of time from 10 to 15 minutes. This series of transfers constituted one cycle. This cycle was repeated five times.

At the conclusion of the test, the capacitors were allowed to stabilize at 25°C. No measurements were made before or after the cycling.

No visual evidence of damage was observed.

MOISTURE RESISTANCE 4.6.14

The capacitors were mounted by their normal mounting means and installed in a horizontal position in a moisture resistance chamber.

The specimens were then conditioned for twenty-four hours at 50°C with an uncontrolled humidity and subjected to ten continuous cycles of humidity environment consisting of a 2 1/2 hour rise to 65°C and stabilization at that temperature for three hours while maintaining 90 to 98% relative humidity. The temperature was then reduced over a 2 1/2 hour period to 25°C, while maintaining 80 to 98% relative humidity, and then again increased for the next 2 1/2 hours to 65°C, while maintaining a 90 to 98% relative humidity. The temperature was maintained at 65°C for three hours, while

maintaining 90 to 98% relative humidity, and then the chamber temperature was reduced to 25°C in 2 1/2 hours while maintaining 80 to 98% relative humidity.

The two alternations at high temperature occurred over a 16 hour period at the conclusion of which, the temperature was stabilized for a period of three hours. At the end of this period, the devices were subjected to a temperature of -10°C for a period of three hours. At the end of this three hour period, the devices were installed on a vibrator and vibrated for fifteen minutes at room ambient temperature with a sinewave acceleration having an amplitude of .06" DA and a frequency varying uniformly between 10 and 55 cycles per second. The frequency sweep from 10 to 55 and return to 10 cycles was traversed in approximately one minute.

During the two humidity-temperature cycles of the first six steps of all humidity cycles, a polarizing potential of 100 VDC was applied from terminal to terminal of one-half of the test samples, while no potential was applied to the remaining half.

After the final cycle, the capacitors were conditioned at 25°C -5° +10°C at a relative humidity of less than 80% for a period of between 22 and 24 hours. At this time the dielectric withstanding voltage and insulation resistance of the capacitor and the capacitor to its case was measured. Capacitance and dissipation factor were also measured at 25°C.

Concluding the electrical test, the capacitors were visually examined for evidence of extensive corrosion and obliteration of markings.

No discrepancies were noted.

3.10.4 Test Group IV - 48 Units

TERMINAL STRENGTH 4.6.15

The terminal strength test as specified in Method 211 of MIL-STD-202 was performed as follows:

Pull Test (Test Condition A) - The capacitor was clamped by one lead and a force of 4 1/2 pounds was applied to the other lead in the direction of the axes of the terminations for a period of 5 to 10 seconds.

Bend Test (Test Condition C) - The body of the capacitor was clamped in a fixture with a load of 2 1/2 pounds suspended at a point within 1/4 inch from the free end of the terminal. The body of the part was slowly inclined so as to bend the terminal through 90° and then return it to normal position with the entire action limited to one vertical plane. A bend through 90° and return to normal position is defined as one bend. Consecutive bends were in the same direction and the load was restricted so that

the bend started 3/32 ± 1/32 inch from the body of the component part. The rate of bending was approximately 3 seconds per bend in each direction.

Twist Test (Test Condition D) - The capacitor was clamped in a suitable fixture and each lead was bent to a 90° angle at a point 1/4" from the body of the capacitor, with a radius of bend approximately 1/32". The terminals were then clamped to within 3/64" ± 1/64" of the bend, and the body of the capacitor was rotated about the original axis of the bent terminals through 360° in alternating directions for three rotations at the rate of approximately five seconds per rotation.

At the conclusion of all testing, the capacitor and terminals were visually examined for signs of mechanical damage.

There was no evidence of mechanical damage, and all leads were intact at the conclusion of the test.

LOW TEMPERATURE AND CAPACITANCE CHANGE WITH TEMPERATURE 4.6.16

The capacitors were placed in a temperature chamber

margin at -55 +0 -5°C and a DC potential equal to the rated voltage

was applied at this temperature for 48 ± 4 hours. At the conclusion of this 48 hour period, the capacitance was measured at low temperature, and the units were removed from the temperature chamber and allowed to stabilize at 25° ± 5°C where the capacitance was again measured.

The capacitors were then stabilized in a high temperature chamber at 125 ± 3°C and the capacitance was again measured. The capacitors were returned to ambient temperature of 25° ± 5°C, and the capacitance again measured.

The measurement of the capacitance at each of the temperatures consisted of two successive readings taken at five minute intervals to indicate that no change in capacitance had occurred.

At the conclusion of this test, the capacitors were visually examined for evidence of breakdown, arcing, open and short circuiting and other visible mechanical damage.

All capacitance changes from the value at 25°C to the low and high ambient temperature were found to be within the specified limits.

3.10.5 Test Group V

LIFE TEST 4.6.18.1

LIFE (ACCELERATED) (60 Units)

The capacitors were subjected to a $2,000^{-0}_{+8}$ hour life test at $125°C^{-0}_{+4}°C$ with an applied DC potential equal to 140% of the rated voltage.

LIFE (RATED) (100 Units)

The capacitors were subjected to a $2,000^{-0}_{+8}$ hour life test at $125°C^{-0}_{+4}°C$ with an applied DC potential equal to the rated voltage.

LIFE TEST PROCEDURES

The life test capacitors were mounted in the chamber at a distance of approximately 1 1/4" from one another to insure adequate circulation. The voltage to each capacitor was applied through an individual current-limiting resistor determined by the formula: $R = \frac{0.025}{C}$. Where C was the nominal capacitance in farads and R was the resistance in ohms not to exceed 2 megohms. The dissipation factor of each sample was measured at 125°C after 24, but not more than 48 hours from the start of the test, and also at a time during the last 48 hours of the test. During these measurements, the DC potential was removed from the capacitor terminals. At the conclusion of 250, 1000, and 2000 hour test periods, the capacitors were returned to ambient conditions where capacitance, dissipation factor, and insulation resistance were measured and recorded. After these measurements, the capacitors were visually examined for evidence of corrosion or mechanical damage.

At the conclusion of 2000 hours, there were defective units outside of the allowable rejects per Table IX of MIL-C-39022. The life testing was repeated using capacitors made from the state-of-the-art

material and all measurements were found to be within the specified limits and no visual evidence of corrosion or mechanical damage was observed (see 3.10.6).

3.10.6 Discussion of Results

Inspection Groups I, II, III and IV of the preproduction tests conformed with the requirements of MIL-C-39022, Table IX. Inspection Group V was not required to be performed.

Inspection Group VI samples completed the required 2000 hours of accelerated life test with very poor results. There were four dielectric breakdowns and eight low insulation resistance rejects. Failure analysis revealed that the rejects were random dielectric failures not related to any specific cause or processing discrepancy.

Discussions were held with the domestic Metallized Polysulfone film supplier who confirmed that this weakness with the material had been observed by other users and was related to the resin and film processing techniques. In the interim, state-of-the-art improvements had resulted in a film improved both physically and electrically.

Permission was granted to repeat the Inspection Group VI life test with capacitors made from the improved quality film. The new capacitors, 40 pieces of each of the four ratings listed in Section 3.10,

were subjected to quality assurance testing of Group I and were then the Group VI life test per paragraph 4.6.18.1 of MIL-C-39022. There were no failures in the 2000 hours of testing.

With the favorable conclusion of the life test section, the preproduction phase of the Production Engineering Measure was satisfactorily completed.

3.11 Phase 4 - Production Run of Metallized Polysulfone Capacitors

3.11.1 Manufacture and Burn-In

The production run was manufactured using the detailed production process developed during the Process Improvement and First Article production phases of the Production Engineering Measure. Since the manufacturing facility in which the First Article and production run was fabricated was dedicated to the production of high quality hermetically sealed capacitors, the state-of-the-art in the production areas was such that all necessary and unique production equipment had previously been developed within the company. Therefore it was not necessary to design, develop, manufacture, or procure either special tooling or design, procure, or fabricate limited production equipment in the performance of this Production Engineering Measure.

The production run of 11,550 capacitors consisted of the following listed part numbers and quantities:

Part Number	Capacitance ±10%	Voltage Rating	Quantity
SCS-301B104K	0.10	100 VDC	1925
SCS-301B105K	1.0	100 VDC	1925
SCS-301B405K	4.0	100 VDC	1925
SCS-301C473K	0.047	200 VDC	1925
SCS-301C334K	0.33	200 VDC	1925
SCS-301C105K	1.0	200 VDC	1925

Manufacture of the entire production lot of 11,550 capacitors was completed with no special problems encountered and all were subjected to the burn-in consisting of the application of 140% of rated voltage for 250 hours at 125°C. The lot satisfactorily completed burn-in.

3.11.2 Group A Tests and Preliminary Measurements

After burn-in the capacitors were subjected to the Group A tests specified in Table XII of MIL-C-39022. The entire lot met the requirements and limits of the Group A testing. See Table XX which is the applicable portion of Table XII of MIL-C-39022.

3.11.3 Initial Capacitance and DF

Initial capacitance of each capacitor was recorded so that a delta C value could be established for each part at the 1000 hour and 10,000 hour measurement points. With a requirement for an acceptable part for test as nominal capacitance ±10%, the test results are listed in Table XXX for each part. All parts were mounted on test racks and placed into the test ovens to be tested for 10,000 hours (see Figures 13, 14, 15 and 16). Initial DF is shown in Table XXXI as delineated in 3.11.6.

TABLE XXX

INITIAL CAPACITIES

SCS-301B104K 0 HOURS

NO OF DATA POINTS 1925 MINIMUM 0.0900 # 245 MAXIMUM 0.1094 # 1106 MEDIAN 0.0982
MEAN VALUE 0.0987 STANDARD DEVIATION 0.0040

FROM	TO	COUNT
0.089	0.090	1
0.090	0.091	15
0.091	0.092	33
0.092	0.093	85
0.093	0.094	113
0.094	0.095	153
0.095	0.096	174
0.096	0.097	212
0.097	0.098	176
0.098	0.099	152
0.099	0.100	143
0.100	0.101	138
0.101	0.102	75
0.102	0.103	115
0.103	0.104	103
0.104	0.105	98
0.105	0.106	66
0.106	0.107	40
0.107	0.108	20
0.108	0.109	8
0.109	0.110	5

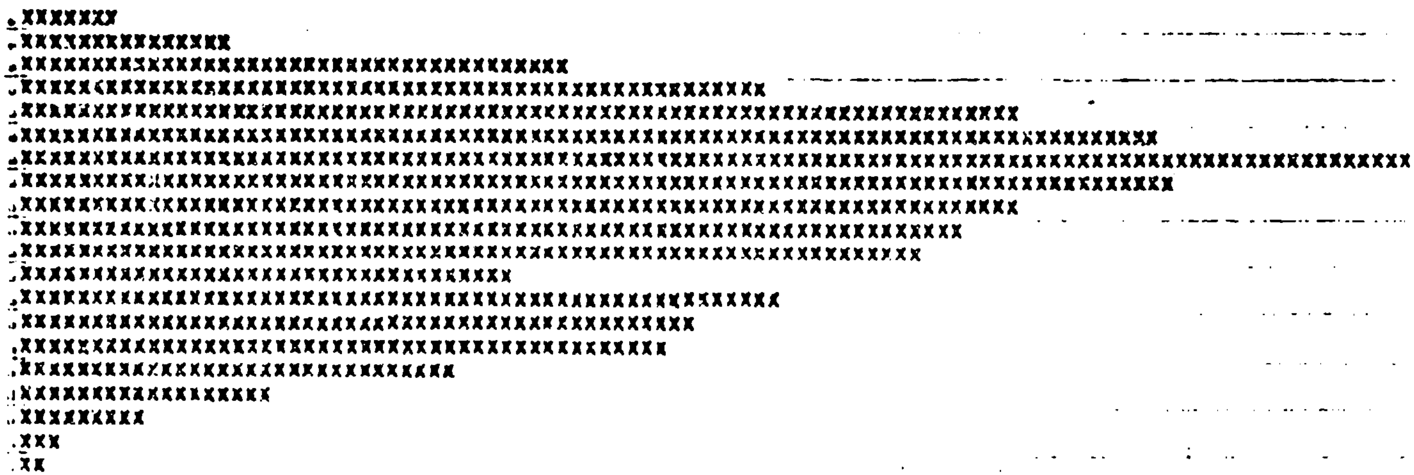


TABLE XXX

INITIAL CAPACITIES

SCS-301B105K — 0 HOURS

NO OF DATA POINTS 1925 MINIMUM 0.9005 # 1647 MAXIMUM 1.0999 # 944 MEDIAN 0.9896
MEAN VALUE 0.9908 STANDARD DEVIATION 0.0405

FROM	TO	COUNT
0.900	0.910	14
0.910	0.920	31
0.920	0.930	67
0.930	0.940	97
0.940	0.950	113
0.950	0.960	140
0.960	0.970	147
0.970	0.980	187
0.980	0.990	194
0.990	1.000	202
1.000	1.010	191
1.010	1.020	127
1.020	1.030	110
1.030	1.040	95
1.040	1.050	66
1.050	1.060	48
1.060	1.070	40
1.070	1.080	23
1.080	1.090	18
1.090	1.100	15

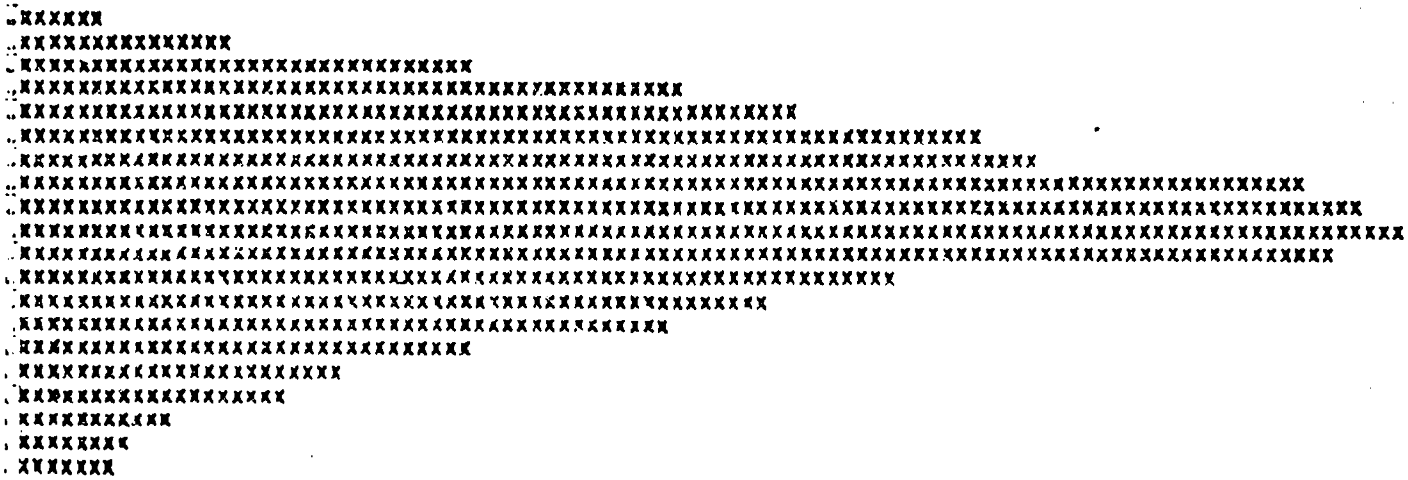


TABLE XXX

INITIAL CAPACITIES

SCS-301B405K 0 HOURS

OF DATA POINTS 1925 MINIMUM 3.6050 # 1723 MAXI[illegible] 4.3710 # 438 MEDIAN 3.9280
MEAN VALUE 3.92[illegible] STANDARD DEVIATION 0.1362

FROM	TO	COUNT
3.600	3.625	1
3.625	3.650	8
3.650	3.675	9
3.675	3.700	33
3.700	3.725	16
3.725	3.750	58
3.750	3.775	45
3.775	3.800	145
3.800	3.825	32
3.825	3.850	167
3.850	3.875	88
3.875	3.900	277
3.900	3.925	63
3.925	3.950	213
3.950	3.975	87
3.975	4.000	212
4.000	4.025	54
4.025	4.050	133
4.050	4.075	33
4.075	4.100	127
4.100	4.125	23
4.125	4.150	36
4.150	4.175	10
4.175	4.200	28
4.200	4.225	1
4.225	4.250	4
4.250	4.275	1
4.275	4.300	0
4.300	4.325	0
4.325	4.350	0
4.350	4.375	1

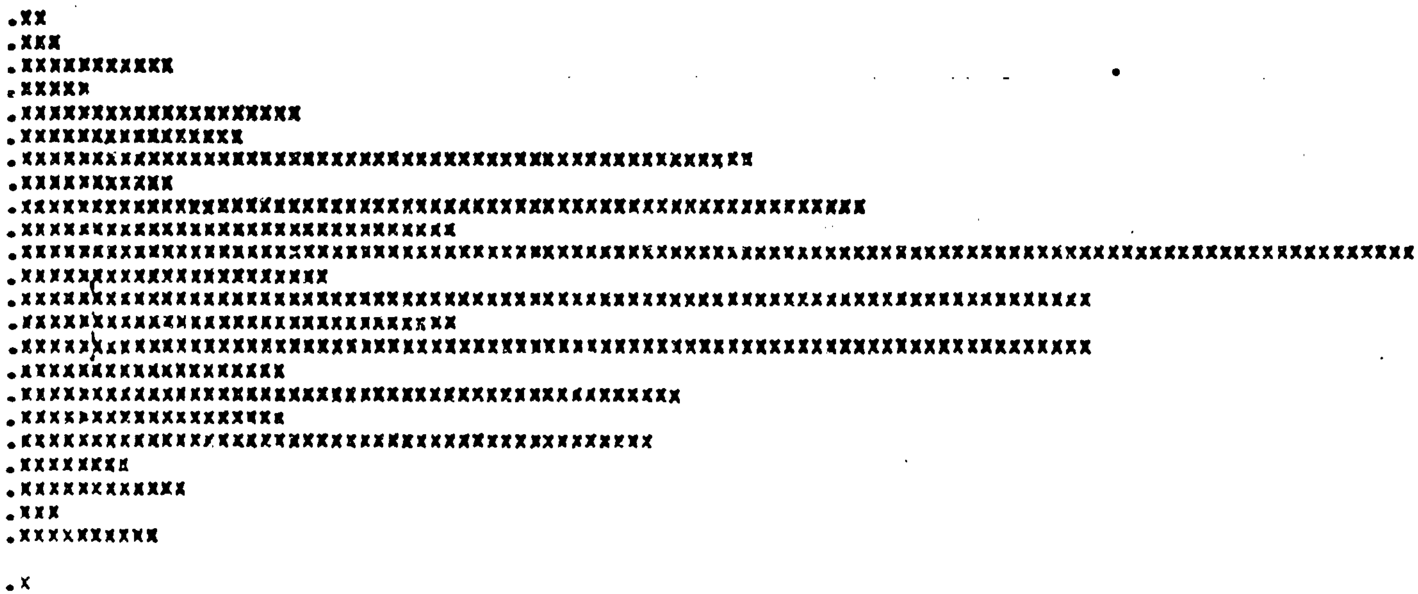


TABLE XXX

INITIAL CAPACITIES

SCS-301V473K 0 HOURS

NO OF DATA POINTS 1925 MINIMUM 0.0429 # 766 MAXIMUM 0.0488 # 1686 MEDIAN 0.0450

MEAN VALUE 0.0452 STANDARD DEVIATION 0.0011

FROM	TO	COUNT	
[illegible]	0.043	4	.X
[illegible]	0.043	1	
[illegible]	0.043	44	.XXXXXXXXXXXXXXX
0.043	0.044	17	.XXXXXX
0.044	0.044	59	.XXXXXXXXXXXXXXXXXXXX
0.044	0.044	169	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.044	45	.XXXXXXXXXXXXXXX
0.044	0.044	242	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.045	37	.XXXXXXXXXXXX
0.045	0.045	133	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.045	229	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.045	41	.XXXXXXXXXXXXXX
0.045	0.045	212	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.046	25	.XXXXXXXX
0.046	0.046	100	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.046	0.046	167	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.046	0.046	25	.XXXXXXXX
0.046	0.046	125	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.046	0.047	17	.XXXXXX
0.047	0.047	59	.XXXXXXXXXXXXXXXXXXXX
0.047	0.047	82	.XXXXXXXXXXXXXXXXXXXXXXXXXXX
0.047	0.047	3	.X
0.047	0.047	55	.XXXXXXXXXXXXXXXXXX
0.047	0.048	8	.XXX
0.048	0.048	15	.XXXXX
0.048	0.048	7	.XX
0.048	0.048	1	
0.048	0.048	1	
0.048	0.049	0	
0.049	0.049	2	

TABLE XXX

INITIAL CAPACITIES

SCS-301C334K 0 HOURS

```
NO OF DATA POINTS    1923  MINIMUM      0.2972  #  1613  MAXIMUM      0.3539  #  231    MEDIAN     0.3272
  MEAN VALUE       0.3262   STANDARD DEVIATION     0.0129
   FROM    TO    COUNT
    0.296   0.298    4   X
    0.298   0.300   16   XXXXX
    0.300   0.302    3   X
    0.302   0.304   40   XXXXXXXXXXXXX
    0.304   0.306    2
    0.306   0.308   31   XXXXXXXXXX
    0.308   0.310  116   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.310   0.312    2
    0.312   0.314  122   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.314   0.316    2
    0.316   0.318   71   XXXXXXXXXXXXXXXXXXXXXXX
    0.318   0.320  203   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.320   0.322    5   X
    0.322   0.324  249   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.324   0.326    9   XXX
    0.326   0.328  137   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.328   0.330  278   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.330   0.332    7   XX
    0.332   0.334  207   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.334   0.336    2
    0.336   0.338  105   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.338   0.340  136   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.340   0.342    1
    0.342   0.344  103   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.344   0.346    0
    0.346   0.348   37   XXXXXXXXXXXX
    0.348   0.350   26   XXXXXXXX
    0.350   0.352    1
    0.352   0.354   10   XXX
```

TABLE XXX

INITIAL CAPACITIES

SCS-301C105K 0 HOURS

NO OF DATA POINTS 1925 MINIMUM 0.9067 # 1326 MAXIMUM 1.0965 # 953 MEDIAN 0.9730
MEAN VALUE 0.9763 STANDARD DEVIATION 0.0347

FROM	TO	COUNT
0.900	0.910	10
0.910	0.920	27
0.920	0.930	82
0.930	0.940	170
0.940	0.950	205
0.950	0.960	224
0.960	0.970	214
0.970	0.980	210
0.980	0.990	205
0.990	1.000	157
1.000	1.010	122
1.010	1.020	109
1.020	1.030	68
1.030	1.040	44
1.040	1.050	29
1.050	1.060	18
1.060	1.070	20
1.070	1.080	5
1.080	1.090	4
1.090	1.100	2

3.11.4 Computer Codes to Histograms

Capacities

Columns 1 and 2 - Capacity in microfarads

Column 3 - Number of units in the capacity range listed in columns 1 and 2

Computer X's - Relative display of column 3 numbers.

Delta Capacities

Columns 1 and 2 - Capacity deviation increments

Column 3 - Number of units in the increment listed in columns 1 and 2

Computer X's - Relative display of column 3 numbers

Total Quantity - The total of the number measured differs from the initial capacity total numbers on some histograms because the computer program did not itemize units exhibiting 0 capacity change.

Dissipation Factor

Columns 1 and 2 - Percent DF. Move decimal point 2 places to the left and read % in both histograms and listing

Column 3 - Number of units between the increments listed in columns 1 and 2

Computer X's - Relative display of column 3 numbers.

3.11.5 Initial Capacity Distribution

Table XXX presents a histogram of the initial capacity distribution. All parts were within limits.

3.11.6 Dissipation Factor Distribution

Table XXXI presents a histogram of the initial DF distribution. These data include a .6% bridge and associated recording interface error in addition to the initial .3% DF limit. All parts were within limits.

3.11.7 Test Implementation (See 3.8.3)

All parts were mounted on the test racks and placed into the ovens, numbers 1, 2 and 3, with the temperature set at 125°C. Rated DC voltage was applied to the capacitors. Capacitor ratings and distribution within the ovens was as follows: 1925 each rating,

Oven Number	Nominal Capacity	Rated Voltage DC
1	0.10 μF	100
1	1.00 μF	100
2	0.047μF	200
2	0.33 μF	200
3	4.00 μF	100
3	1.00 μF	200

3.11.8 1000 Hour Test Results

The initial capacitance and dissipation factor measurements, recorded prior to extended life test were analyzed for comparison to the capacitance and dissipation factor measurements recorded following completion of 1000 hours of extended life test. The analysis revealed one (1) failure in the 0.047μF - 200VDC capacitors. All other units were within the limits prescribed by this contract.

TABLE XXXI

INITIAL DF

SCS-301B104K 0 HOURS

NO OF DATA POINTS 1925 MINIMUM 0.0000 # 19 MAXIMUM 31.0000 # 191 MEDIAN 7.0000
MEAN VALUE 6.9605 STANDARD DEVIATION 4.7236

FROM	TO	COUNT
0.000	1.000	298
1.000	2.000	118
2.000	3.000	91
3.000	4.000	94
4.000	5.000	138
5.000	6.000	177
6.000	7.000	183
7.000	8.000	153
8.000	9.000	141
9.000	10.000	144
10.000	11.000	63
11.000	12.000	83
12.000	13.000	60
13.000	14.000	69
14.000	15.000	43
15.000	16.000	28
16.000	17.000	10
17.000	18.000	6
18.000	19.000	6
19.000	20.000	3
20.000	21.000	2
21.000	22.000	2
22.000	23.000	3
23.000	24.000	2
24.000	25.000	3
25.000	26.000	0
26.000	27.000	2
27.000	28.000	1
28.000	29.000	0
29.000	30.000	1
30.000	31.000	1

TABLE XXXI

INITIAL DF

SCS-301B105K   0 HOURS

NO OF DATA POINTS 1925 MINIMUM 10.0000 # 753 MAXIMUM 55.0000 # 871 MEDIAN 35.0000

MEAN VALUE 34.2883 STANDARD DEVIATION 7.1929

FROM	TO	COUNT
8.000	10.000	1
10.000	12.000	0
12.000	14.000	0
14.000	16.000	0
16.000	18.000	0
18.000	20.000	19
20.000	22.000	43
22.000	24.000	85
24.000	26.000	178
26.000	28.000	205
28.000	30.000	124
30.000	32.000	167
32.000	34.000	114
34.000	36.000	173
36.000	38.000	144
38.000	40.000	203
40.000	42.000	236
42.000	44.000	96
44.000	46.000	82
46.000	48.000	22
48.000	50.000	15
50.000	52.000	12
52.000	54.000	4
54.000	56.000	2

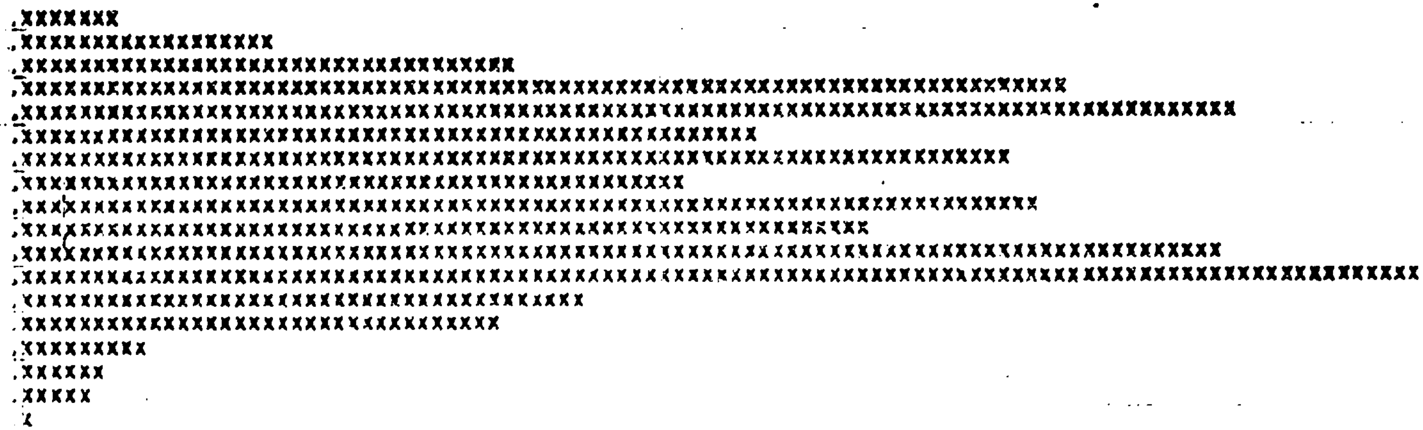


TABLE XXXI

INITIAL DF

SCS-301B405K   0 HOURS

```
# OF DATA POINTS    1925  MINIMUM      1.0000  #  1207  MAXIMUM     60.0000  #  949    MEDIAN     30.0000
MEAN VALUE     30.0021    STANDARD DEVIATION      5.4162
 FROM    TO      COUNT
   0.000    2.000    3
   2.000    4.000    5   .X
   4.000    6.000    2
   6.000    8.000    1
   8.000   10.000    4
  10.000   12.000    9   .XX
  12.000   14.000    6   .X
  14.000   16.000   16   .XXX
  16.000   18.000    7   .X
  18.000   20.000   14   .XXX
  20.000   22.000   15   .XXX
  22.000   24.000   67   .XXXXXXXXXXXXXXX
  24.000   26.000  226   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  26.000   28.000  413   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  28.000   30.000  299   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  30.000   32.000  235   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  32.000   34.000  198   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  34.000   36.000  206   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  36.000   38.000  142   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  38.000   40.000   32   .XXXXXXX
  40.000   42.000   10   .XX
  42.000   44.000    7   .X
  44.000   46.000    3
  46.000   48.000    2
  48.000   50.000    1
  50.000   52.000    0
  52.000   54.000    1
  54.000   56.000    0
  56.000   58.000    0
  58.000   60.000    1
```

TABLE XXXI

INITIAL DF

SCS-301C473K 0 HOURS

D OF DATA POINTS 1925 MINIMUM 0.0000 # 62 MAXIMUM 35.0000 # 1908 MEDIAN 7.0000

MEAN VALUE 10.8971 STANDARD DEVIATION 9.8040

FROM	TO	COUNT
0.000	1.000	93
1.000	2.000	139
2.000	3.000	168
3.000	4.000	177
4.000	5.000	202
5.000	6.000	160
6.000	7.000	114
7.000	8.000	115
8.000	9.000	72
9.000	10.000	61
10.000	11.000	36
11.000	12.000	35
12.000	13.000	18
13.000	14.000	4
14.000	15.000	4
15.000	16.000	3
16.000	17.000	15
17.000	18.000	19
18.000	19.000	163
19.000	20.000	24
20.000	21.000	24
21.000	22.000	29
22.000	23.000	21
23.000	24.000	5
24.000	25.000	7
25.000	26.000	6
26.000	27.000	3
27.000	28.000	2
28.000	29.000	2
29.000	30.000	12
30.000	31.000	22
31.000	32.000	23
32.000	33.000	40
33.000	34.000	52
34.000	35.000	55

TABLE XXXI

INITIAL DF

SCS-301C334K 0 HOURS

```
NO OF DATA POINTS    1925  MINIMUM       0.0000  #   918  MAXIMUM    59.0000  # 1740   MEDIAN    16.0000
  MEAN VALUE     18.9221    STANDARD DEVIATION     8.4304
   FROM    TO    COUNT
    0.000    2.000    3
    2.000    4.000    4
    4.000    6.000    3
    6.000    8.000   12  .XX
    8.000   10.000   57  .XXXXXXXXXXX
   10.000   12.000  155  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   12.000   14.000  283  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   14.000   16.000  446  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   16.000   18.000  295  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   18.000   20.000  207  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   20.000   22.000   96  .XXXXXXXXXXXXXXXXXXX
   22.000   24.000   94  .XXXXXXXXXXXXXXXXXX
   24.000   26.000   31  .XXXXXX
   26.000   28.000    3  .
   28.000   30.000   18  .XXX
   30.000   32.000   41  .XXXXXXXX
   32.000   34.000   64  .XXXXXXXXXXXX
   34.000   36.000    4
   36.000   38.000    3
   38.000   40.000   27  .XXXXX
   40.000   42.000   11  .XX
   42.000   44.000   18  .XXX
   44.000   46.000   22   XXXX
   46.000   48.000    7   X
   48.000   50.000    2
   50.000   52.000    1
   52.000   54.000    7   X
   54.000   56.000    3
   56.000   58.000    4
   58.000   60.000    4
```

TABLE XXXI

INITIAL DF

SCS-301C105K 0 HOURS

NO OF DATA POINTS 1925 MINIMUM 25.0000 # 221 MAXIMUM 55.0000 # 1376 MEDIAN 40.0000
MEAN VALUE 39.0473 STANDARD DEVIATION 5.7832

FROM	TO	COUNT
24.000	25.000	1
25.000	26.000	5
26.000	27.000	13
27.000	28.000	31
28.000	29.000	66
29.000	30.000	70
30.000	31.000	80
31.000	32.000	80
32.000	33.000	68
33.000	34.000	63
34.000	35.000	66
35.000	36.000	81
36.000	37.000	90
37.000	38.000	65
38.000	39.000	133
39.000	40.000	138
40.000	41.000	181
41.000	42.000	135
42.000	43.000	119
43.000	44.000	95
44.000	45.000	87
45.000	46.000	83
46.000	47.000	64
47.000	48.000	43
48.000	49.000	33
49.000	50.000	8
50.000	51.000	12
51.000	52.000	6
52.000	53.000	4
53.000	54.000	2
54.000	55.000	3

The one failure that occurred after 1000 hours of extended life test was disassembled to determine the cause of failure. Electrical measurements showed the capacitor (P/N SCS-301C473K, 0.047µF - 200 VDC) to be an open circuit. Failure of the capacitor was attributed to internal pressure which ruptured the endseal causing separation of the lead wire from the section. The section was checked electrically and it remained within the contract limits. The internal pressure was judged to be mechanical generated by the 125°C temperature. It is believed that the modification of manufacturing controls on the section size would prevent a reoccurance of this failure mode.

3.11.8.1 Capacities at 1000 Hours

Table XXXII presents a histogram of the capacity distribution at the 1000 hour readout.

3.11.9 Delta Capacities at 1000 Hours

Table XXXIII presents a histogram of the Delta Capacities. The 1000 hour readout of capacity for each unit was compared with the initial capacity value read for that unit and the histogram derived from the percent capacity change for each unit. All parts (except 1) met the specified limits.

3.11.10 Capacities at Readout Intervals

Table XXXIV presents histograms of the capacity distribution and Delta C for 50 of each capacity value measured at 250, 2000, and 4000 hours, as applicable to ovens #1, #2 and #3 and the ratings therein

TABLE XXXII

CAPACITIES

SCS-301B104K 1000 HOURS

NO OF DATA POINTS 1925 MINIMUM 0.0898 # 349 MAXIMUM 0.1084 # 1106 MEDIAN 0.0973
MEAN VALUE 0.0976 STANDARD DEVIATION 0.0038

FROM	TO	COUNT
0.089	0.090	6
0.090	0.091	30
0.091	0.092	79
0.092	0.093	127
0.093	0.094	146
0.094	0.095	161
0.095	0.096	197
0.096	0.097	208
0.097	0.098	156
0.098	0.099	160
0.099	0.100	121
0.100	0.101	130
0.101	0.102	94
0.102	0.103	112
0.103	0.104	80
0.104	0.105	73
0.105	0.106	26
0.106	0.107	11
0.107	0.108	6
0.108	0.109	2

TABLE XXXII

CAPACITIES

SCS-301B105K   1000 HOURS

NO OF DATA POINTS 1925 MINIMUM 0.8896 # 1647 MAXIMUM 1.0995 # 944 MEDIAN 0.9836
MEAN VALUE 0.9857 STANDARD DEVIATION 0.0408

FROM	TO	COUNT
0.880	0.890	1
0.890	0.900	5
0.900	0.910	24
0.910	0.920	50
0.920	0.930	82
0.930	0.940	116
0.940	0.950	128
0.950	0.960	138
0.960	0.970	177
0.970	0.980	193
0.980	0.990	182
0.990	1.000	191
1.000	1.010	170
1.010	1.020	109
1.020	1.030	106
1.030	1.040	73
1.040	1.050	53
1.050	1.060	49
1.060	1.070	31
1.070	1.080	24
1.080	1.090	13
1.090	1.100	8

TABLE XXXII

CAPACITIES

SCS-301B405K 1000 HOURS

```
# OF DATA POINTS    1925  MINIMUM       3.5840  # 1723  MAXIMUM    4.3400  # 438   MEDIAN    3.9200
MEAN VALUE       3.9164   STANDARD DEVIATION     0.1351
```

FROM	TO	COUNT
3.575	3.600	2
3.600	3.625	0
3.625	3.650	8
3.650	3.675	12
3.675	3.700	42
3.700	3.725	7
3.725	3.750	73
3.750	3.775	47
3.775	3.800	166
3.800	3.825	29
3.825	3.850	186
3.850	3.875	98
3.875	3.900	276
3.900	3.925	51
3.925	3.950	218
3.950	3.975	85
3.975	4.000	216
4.000	4.025	37
4.025	4.050	140
4.050	4.075	43
4.075	4.100	118
4.100	4.125	10
4.125	4.150	35
4.150	4.175	11
4.175	4.200	17
4.200	4.225	1
4.225	4.250	4
4.250	4.275	0
4.275	4.300	0
4.300	4.325	0
4.325	4.350	1

TABLE XXXII

CAPACITIES

```
           SCS-301C473K                     1000 HOURS
NO OF DATA POINTS      1924  MINIMUM      0.0426  #   765  MAXIMUM      0.0489  # 1529    MEDIAN     0.0448
  MEAN VALUE        0.0449    STANDARD DEVIATION      0.0011
   FROM    TO      COUNT
     0.043      0.043     3
     0.043      0.043    37   .XXXXXXXXXXXX
     0.043      0.043    12   .XXX
     0.043      0.044   110   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
     0.044      0.044    80   .XXXXXXXXXXXXXXXXXXXXXXXXXX
     0.044      0.044   300   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
     0.044      0.044    48   .XXXXXXXXXXXXXXX
     0.044      0.045   237   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
     0.045      0.045    92   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
     0.045      0.045   284   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
     0.045      0.045    30   .XXXXXXXXX
     0.045      0.046   182   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
     0.046      0.046    58   .XXXXXXXXXXXXXXXXXXX
     0.046      0.046   169   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
     0.046      0.046    25   .XXXXXXXX
     0.046      0.047   101   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
     0.047      0.047    29   .XXXXXXXXX
     0.047      0.047    79   .XXXXXXXXXXXXXXXXXXXXXXXXXX
     0.047      0.047     9   .XX
     0.047      0.048    26   .XXXXXXXX
     0.048      0.048     5   .X
     0.048      0.048     6   .X
     0.048      0.048     0
     0.048      0.049     0
     0.049      0.049     1
     0.049      0.049     1
```

TABLE XXXII

CAPACITIES

```
          SCS-301C334K                 1000 HOURS
NO OF DATA POINTS    1925  MINIMUM      0.2867  #   953  MAXIMUM      0.3539  #  371    MEDIAN     0.3256
  MEAN VALUE      0.3237    STANDARD DEVIATION      0.0127
    FROM    TO     COUNT
    0.285    0.288     1
    0.288    0.290     1
    0.290    0.293     1
    0.293    0.295     3  .X
    0.295    0.298     3  .X
    0.298    0.300    29  .XXXXXXXXXX
    0.300    0.303    10  .XXX
    0.303    0.305    54  .XXXXXXXXXXXXXXXXXX
    0.305    0.308    46  .XXXXXXXXXXXXXXX
    0.308    0.310   129  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.310    0.313    33  .XXXXXXXXXXX
    0.313    0.315   111  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.315    0.318    90  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.318    0.320   259  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.320    0.323    51  .XXXXXXXXXXXXXXXXX
    0.323    0.325   241  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.325    0.328   112  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.328    0.330   267  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.330    0.333    26  .XXXXXXXXX
    0.333    0.335   160  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.335    0.338    54  .XXXXXXXXXXXXXXXXXX
    0.338    0.340   134  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.340    0.343    17  .XXXXXX
    0.343    0.345    64  .XXXXXXXXXXXXXXXXXXXXX
    0.345    0.348    16  .XXXXX
    0.348    0.350     8  .XX
    0.350    0.353     2
    0.353    0.355     3  .X
```

TABLE XXXII

CAPACITIES

SCS-301C105K 1000 HOURS

OF DATA POINTS 1925 MINIMUM 0.9035 # 1326 MAXIMUM 1.0899 # 953 MEDIAN 0.9696
MEAN VALUE 0.9737 STANDARD DEVIATION 0.0342

FROM	TO	COUNT
0.900	0.910	9
0.910	0.920	37
0.920	0.930	108
0.930	0.940	189
0.940	0.950	196
0.950	0.960	235
0.960	0.970	220
0.970	0.980	196
0.980	0.990	199
0.990	1.000	152
1.000	1.010	117
1.010	1.020	104
1.020	1.030	49
1.030	1.040	44
1.040	1.050	28
1.050	1.060	20
1.060	1.070	14
1.070	1.080	6
1.080	1.090	2

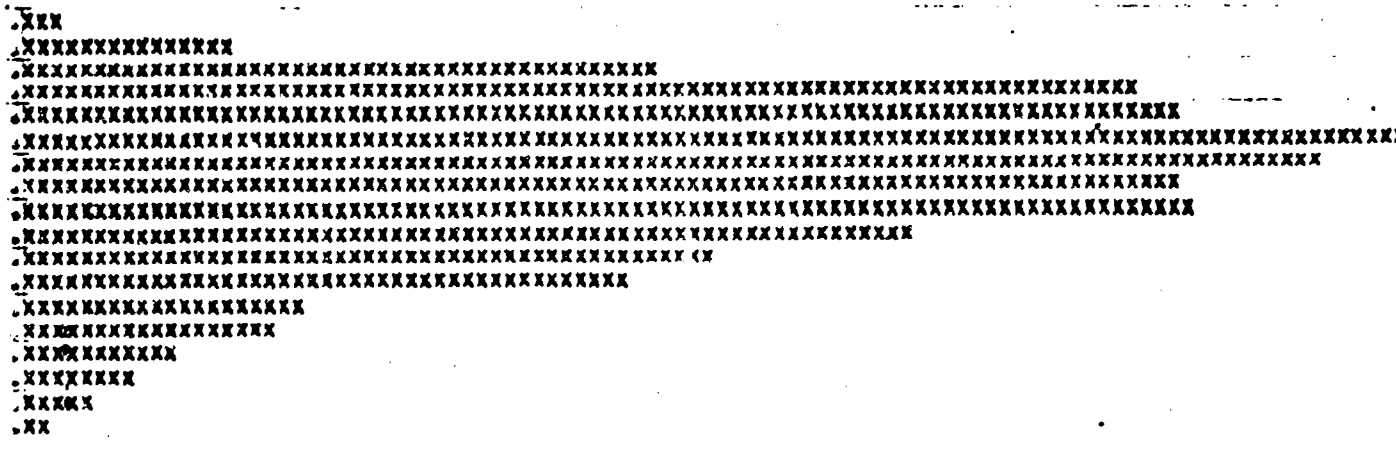


TABLE XXXIII

DELTA CAPACITIES

SCS-301B104K 1000 HOURS

```
NO OF DATA POINTS    1925  MINIMUM      0.0000 #     TO  MAXIMUM      0.0091 # 1460     MEDIAN     0.0010
   MEAN VALUE      0.0011   STANDARD DEVIATION      0.0007
     FROM    TO      COUNT
    0.000     0.001   301   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.001     0.001   752   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.001     0.002   520   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.002     0.002   178   .XXXXXXXXXXXXXXXXXXXXXXX
    0.002     0.003    97   .XXXXXXXXXXXX
    0.003     0.003    58   .XXXXXXX
    0.003     0.004     6
    0.004     0.004     2
    0.004     0.005     3
    0.005     0.005     0
    0.005     0.006     2
    0.006     0.006     0
    0.006     0.007     0
    0.007     0.007     1
    0.007     0.008     2
    0.008     0.008     1
    0.008     0.009     1
    0.009     0.009     0
    0.009     0.010     1
```

TABLE XXXIII

DELTA CAPACITIES

SCS-301B105K 1000 HOURS

NO OF DATA POINTS 1925 MINIMUM 0.0000 # 3 MAXIMUM 0.0965 # 1490 MEDIAN 0.0041
MEAN VALUE 0.0052 STANDARD DEVIATION 0.0051

FROM	TO	COUNT	
0.000	0.005	1138	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.005	0.010	574	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.010	0.015	170	.XXXXXXXXXXXXX
0.015	0.020	28	.XX
0.020	0.025	5	
0.025	0.030	3	
0.030	0.035	2	
0.035	0.040	1	
0.040	0.045	0	
0.045	0.050	0	
0.050	0.055	0	
0.055	0.060	1	
0.060	0.065	2	
0.065	0.070	0	
0.070	0.075	0	
0.075	0.080	0	
0.080	0.085	0	
0.085	0.090	0	
0.090	0.095	0	
0.095	0.100	1	

TABLE XXXIII

DELTA CAPACITIES

SCS-301B405K 1000 HOURS

OF DATA POINTS 1925 MINIMUM 0.0000 # 69 MAXIMUM 0.3360 # 218 MEDIAN 0.0060
MEAN VALUE 0.0141 STANDARD DEVIATION 0.0270

FROM	TO	COUNT	
0.000	0.010	1277	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.010	0.020	188	.XXXXXXXXXXXXX
0.020	0.030	344	.XXXXXXXXXXXXXXXXXXXXXXXX
0.030	0.040	54	.XXX
0.040	0.050	12	
0.050	0.060	1	
0.060	0.070	2	
0.070	0.080	4	
0.080	0.090	3	
0.090	0.100	4	
0.100	0.110	5	
0.110	0.120	0	
0.120	0.130	2	
0.130	0.140	3	
0.140	0.150	4	
0.150	0.160	1	
0.160	0.170	2	
0.170	0.180	0	
0.180	0.190	0	
0.190	0.200	4	
0.200	0.210	3	
0.210	0.220	3	
0.220	0.230	0	
0.230	0.240	1	
0.240	0.250	1	
0.250	0.260	0	
0.260	0.270	1	
0.270	0.280	0	
0.280	0.290	0	
0.290	0.300	1	
0.300	0.310	0	
0.310	0.320	1	
0.320	0.330	1	
0.330	0.340	1	

TABLE XXXIII

DELTA CAPACITIES

SCS-301C473K 1000 HOURS

```
NO OF DATA POINTS    1924  MINIMUM      0.0000  #     8  MAXIMUM    0.0036  #  215   MEDIAN    0.0004
 MEAN VALUE        0.0004   STANDARD DEVIATION    0.0003
  FROM    TO     COUNT
   0.000     0.000  359  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.000     0.000  175  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.000     0.000  279  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.000     0.000  419  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.000     0.001  251  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.001     0.001  185  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.001     0.001   72  .XXXXXXXXXXXXXX
   0.001     0.001   51  .XXXXXXXXXX
   0.001     0.001   56  .XXXXXXXXXXX
   0.001     0.001   54  .XXXXXXXXXXX
   0.001     0.001    6  .X
   0.001     0.001    3
   0.001     0.001    2
   0.001     0.001    2
   0.001     0.002    2
   0.002     0.002    2
   0.002     0.002    2
   0.002     0.002    2
   0.002     0.002    0
   0.002     0.002    2
   0.002     0.002    0
   0.002     0.002    0
   0.002     0.002    0
   0.002     0.002    1
   0.002     0.003    0
   0.003     0.003    0
   0.003     0.003    1
   0.003     0.003    0
   0.003     0.003    1
   0.003     0.003    0
   0.003     0.003    0
   0.003     0.003    0
   0.003     0.003    0
   0.003     0.003    0
   0.003     0.004    0
   0.004     0.004    1
```

TABLE XXXIII

DELTA CAPACITIES

SCS-301C334K 1000 HOURS

NO OF DATA POINTS 1925 MINIMUM 0.0000 # 9 MAXIMUM 0.0239 # 1486 MEDIAN 0.0028
MEAN VALUE 0.0027 STANDARD DEVIATION 0.0017

FROM	TO	COUNT	
0.000	0.001	320	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.002	417	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.002	0.003	328	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.003	0.004	561	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.004	0.005	218	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.005	0.006	48	.XXXXXXXX
0.006	0.007	14	.XX
0.007	0.008	6	.X
0.008	0.009	3	
0.009	0.010	2	
0.010	0.011	1	
0.011	0.012	0	
0.012	0.013	1	
0.013	0.014	0	
0.014	0.015	2	
0.015	0.016	1	
0.016	0.017	0	
0.017	0.018	0	
0.018	0.019	1	
0.019	0.020	0	
0.020	0.021	0	
0.021	0.022	0	
0.022	0.023	1	
0.023	0.024	1	

TABLE XXXIII

DELTA CAPACITIES

SCS-301C105K   1000 HOURS

```
NO OF DATA POINTS     1925  MINIMUM        0.0000  #   135  MAXIMUM      0.0938  #  660   MEDIAN      0.0031
  MEAN VALUE       0.0044   STANDARD DEVIATION       0.0090
   FROM    TO      COUNT
    0.000       0.005 1676  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.005       0.010  153   XXXXXXX
    0.010       0.015   10
    0.015       0.020   19
    0.020       0.025   10
    0.025       0.030   1G
    0.030       0.035    3
    0.035       0.040    8
    0.040       0.045    7
    0.045       0.050    6
    0.050       0.055    4
    0.055       0.060    4
    0.060       0.065    4
    0.065       0.070    2
    0.070       0.075    0
    0.075       0.080    4
    0.080       0.085    1
    0.085       0.090    1
    0.090       0.095    3
```

TABLE XXXIV

INITIAL CAPACITIES

SCS-301B104K 250 HOURS

# OF DATA POINTS	50	MINIMUM	0.0918	#	33	MAXIMUM	0.1064	#	43	MEDIAN 0.0969
MEAN VALUE	0.0971	STANDARD DEVIATION	0.0033							

FROM	TO	COUNT	
[illegible]	0.092	1	.XXXXXXXXXXXXXX
0.092	0.093	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
[illegible]	0.093	1	.XXXXXXXXXXXXXX
0.093	0.094	1	.XXXXXXXXXXXXXX
[illegible]	0.094	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
[illegible]	0.095	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
[illegible]	0.095	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.095	0.095	0	.
[illegible]	0.096	0	.
[illegible]	0.096	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
[illegible]	0.097	7	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.097	0.097	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
[illegible]	0.098	6	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
[illegible]	[illegible]	1	.XXXXXXXXXXXXXX
[illegible]	[illegible]	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
[illegible]	0.099	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXX
[illegible]	0.100	1	.XXXXXXXXXXXXXX
[illegible]	0.100	0	
[illegible]	0.101	0	
0.101	0.101	0	
[illegible]	0.102	0	
[illegible]	0.102	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
[illegible]	0.103	0	
[illegible]	0.103	1	.XXXXXXXXXXXXXX
[illegible]	0.104	1	.XXXXXXXXXXXXXX
0.104	0.104	0	
[illegible]	0.105	0	
[illegible]	0.105	0	
0.105	0.105	0	
[illegible]	0.106	1	.XXXXXXXXXXXXXX

TABLE XXXIV

FINAL CAPACITIES

SCS-301B104K 250 HOURS

NO. OF DATA POINTS 50 MINIMUM 0.0909 # 33 MAXIMUM 0.1029 # 43 MEDIAN 0.0959
MEAN VALUE 0.0958 STANDARD DEVIATION 0.0027

FROM	TO	COUNT	
0.091	0.091	2	.XXXXXXXXXXXXXXXXXXXXXXXXX
0.091	0.092	0	
0.092	0.092	2	.XXXXXXXXXXXXXXXXXXXXXXXXX
0.092	0.093	2	.XXXXXXXXXXXXXXXXXXXXXXXXX
0.093	0.093	0	
0.093	0.093	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.093	0.094	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.094	0.094	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.094	0.095	1	.XXXXXXXXXXXX
0.095	0.095	2	.XXXXXXXXXXXXXXXXXXXXXXXXX
0.095	0.096	6	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.096	0.096	6	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.096	0.097	8	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.097	0.097	2	.XXXXXXXXXXXXXXXXXXXXXXXXX
0.097	0.098	0	
0.098	0.098	1	.XXXXXXXXXXXX
0.098	0.099	1	.XXXXXXXXXXXX
0.099	0.099	1	.XXXXXXXXXXXX
0.099	0.100	1	.XXXXXXXXXXXX
0.100	0.100	0	
0.100	0.101	1	.XXXXXXXXXXXX
0.101	0.101	1	.XXXXXXXXXXXX
0.101	0.102	0	
0.102	0.102	1	.XXXXXXXXXXXX
0.102	0.103	1	.XXXXXXXXXXXX

TABLE XXXIV

DELTA CAPACITIES

SCS-301B104K **250 HOURS**

OF DATA POINTS 50 MINIMUM 0.0003 # 8 MAXIMUM 0.0079 # 11 MEDIAN 0.0009
MEAN VALUE 0.0013 STANDARD DEVIATION 0.0015

FROM	TO	COUNT	
[illegible]	0.001	9	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.001	12	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.001	15	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.001	2	.XXXXXXXXXXXX
0.001	0.002	3	.XXXXXXXXXXXXXXXXX
0.002	0.002	2	.XXXXXXXXXXXX
0.002	0.002	2	.XXXXXXXXXXXX
0.002	0.002	0	
0.002	0.003	1	.XXXXXX
0.003	0.003	1	.XXXXXX
0.003	0.003	0	
0.003	0.003	0	
0.003	0.004	1	.XXXXXX
0.004	0.004	0	
0.004	0.004	0	
0.004	0.004	0	
0.004	0.005	0	
0.005	0.005	0	
0.005	0.005	0	
0.005	0.005	0	
0.005	0.006	0	
0.006	0.006	0	
[illegible]	0.006	0	
0.006	0.006	0	
0.006	0.007	0	
0.007	0.007	0	
0.007	0.007	0	
0.007	0.007	0	
0.007	0.008	1	.XXXXXX
[illegible]	0.008	0	
[illegible]	0.008	1	.XXXXXX

TABLE XXXIV

INITIAL CAPACITIES

SCS-301B105K 250 HOURS

DATA POINTS	50	MINIMUM	0.9139	#	2	MAXIMUM	1.0930	#	46	MEDIAN	0.9799
MEAN VALUE	0.9812	STANDARD DEVIATION	0.0421								

FROM	TO	COUNT	
0.910	0.920	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.920	0.930	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.930	0.940	6	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.940	0.950	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.950	0.960	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.960	0.970	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.970	0.980	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.980	0.990	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.990	1.000	8	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.000	1.010	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.010	1.020	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.020	1.030	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.030	1.040	1	.XXXXXXXXXXXXXXXXXXXX
1.040	1.050	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.050	1.060	0	
1.060	1.070	0	
1.070	1.080	0	
1.080	1.090	1	.XXXXXXXXXXXXXXXXXXXX
1.090	1.100	1	.XXXXXXXXXXXXXXXXXXXX

TABLE XXXIV

INITIAL CAPACITIES

SCS-301B165K **250 HOURS**

DATA POINTS 50 MINIMUM 0.9139 # 2 MAXIMUM 1.0930 # 46 MEDIAN 0.9799
VALUE 0.9812 STANDARD DEVIATION 0.0421

VALUE	TO	COUNT
0.910	0.920	2
0.920	0.930	3
0.930	0.940	6
0.940	0.950	3
0.950	0.960	5
0.960	0.970	3
0.970	0.980	4
0.980	0.990	3
0.990	1.000	8
1.000	1.010	4
1.010	1.020	2
1.020	1.030	2
1.030	1.040	1
1.040	1.050	3
1.050	1.060	0
1.060	1.070	0
1.070	1.080	0
1.080	1.090	1
1.090	1.100	1

TABLE XXXIV

FINAL CAPACITIES

SCS-301B105K **250 HOURS**

```
OF DATA POINTS      50  MINIMUM      0.9137  #   19  MAXIMUM      1.0628  #   46   MEDIAN      0.9793
MEAN VALUE     0.9795   STANDARD DEVIATION     0.0414
FROM    TO     COUNT
 0.910   0.920   2   .XXXXXXXXXXXXXXXXXXXXXXXXXX
 0.920   0.930   4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.930   0.940   5   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.940   0.950   3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.950   0.960   4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.960   0.970   3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.970   0.980   4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.980   0.990   8   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.990   1.000   2   .XXXXXXXXXXXXXXXXXXXXXXXXXX
 1.000   1.010   4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 1.010   1.020   2   .XXXXXXXXXXXXXXXXXXXXXXXXXX
 1.020   1.030   3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 1.030   1.040   2   .XXXXXXXXXXXXXXXXXXXXXXXXXX
 1.040   1.050   0
 1.050   1.060   1   .XXXXXXXXXXXXX
 1.060   1.070   0
 1.070   1.080   0
 1.080   1.090   2   .XXXXXXXXXXXXXXXXXXXXXXXXXX
```

TABLE XXXIV

DELTA CAPACITIES

SCS-301B105K **250 HOURS**

```
DATA POINTS       50  MINIMUM        0.0000 #     3  MAXIMUM      0.0190 #  13   MEDIAN      0.0022
N VALUE       0.0029  STANDARD DEVIATION      0.0035
FROM    TO    COUNT
0.000   0.001   16  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001   0.002    8  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.002   0.003    8  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.003   0.004    6  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.004   0.005    7  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.005   0.006    1  .XXXXXX
0.006   0.007    1  .XXXXXX
0.007   0.008    1  .XXXXXX
0.008   0.009    0
0.009   0.010    0
0.010   0.011    0
0.011   0.012    0
0.012   0.013    0
0.013   0.014    0
0.014   0.015    1  .XXXXXX
0.015   0.016    0
0.016   0.017    0
0.017   0.018    0
0.018   0.019    1  .XXXXXX
```

TABLE XXXIV

INITIAL CAPACITIES

SCS-301B405K **250 HOURS**

```
OF DATA POINTS      50  MINIMUM      3.6660  #   19  MAXIMUM      4.0970  #   37    MEDIAN       3.8910
EAN VALUE      3.8841   STANDARD DEVIATION     0.1022
FROM    TO     COUNT
 3.660   3.680   1   .XXXXXXXXXXXXXX
 3.680   3.700   1   .XXXXXXXXXXXXXX
 3.700   3.720   1   .XXXXXXXXXXXXXX
 3.720   3.740   2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXX
 3.740   3.760   0
 3.760   3.780   2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXX
 3.780   3.800   5   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 3.800   3.820   1   .XXXXXXXXXXXXXX
 3.820   3.840   6   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 3.840   3.860   0
 3.860   3.880   3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 3.880   3.900   7   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 3.900   3.920   2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXX
 3.920   3.940   5   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 3.940   3.960   0
 3.960   3.980   3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 3.980   4.000   5   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 4.000   4.020   0
 4.020   4.040   4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 4.040   4.060   0
 4.060   4.080   1   .XXXXXXXXXXXXXX
 4.080   4.100   1   .XXXXXXXXXXXXXX
```

TABLE XXXIV

FINAL CAPACITIES

SCS-301B405K 250 HOURS

DATA POINTS 50 MINIMUM 3.6400 # 19 MAXIMUM 4.0950 # 37 MEDIAN 3.8860
MEAN VALUE 3.8764 STANDARD DEVIATION 0.1033

FROM	TO	COUNT	
3.620	3.640	1	.XXXXXXXXXX
3.640	3.660	0	
3.660	3.680	0	
3.680	3.700	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.700	3.720	0	
3.720	3.740	1	.XXXXXXXXXX
3.740	3.760	0	
3.760	3.780	2	.XXXXXXXXXXXXXXXXXXXX
3.780	3.800	6	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.800	3.820	0	
3.820	3.840	8	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.840	3.860	1	.XXXXXXXXXX
3.860	3.880	2	.XXXXXXXXXXXXXXXXXXXX
3.880	3.900	9	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.900	3.920	0	
3.920	3.940	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.940	3.960	0	
3.960	3.980	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.980	4.000	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.000	4.020	0	
4.020	4.040	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.040	4.060	0	
4.060	4.080	1	.XXXXXXXXXX
4.080	4.100	1	.XXXXXXXXXX

TABLE XXXIV

DELTA CAPACITIES

SCS-301B405K **250 HOURS**

DATA POINTS 50 MINIMUM 0.0000 # 21 MAXIMUM 0.0340 # 29 MEDIAN 0.0040

VALUE 0.0077 STANDARD DEVIATION 0.0085

	TO	COUNT	
0.000	0.001	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.002	8	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.002	0.003	9	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.003	0.004	9	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.004	0.005	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.005	0.006	1	.XXXXXXXXXXX
0.006	0.007	0	
0.007	0.008	1	.XXXXXXXXXXX
0.008	0.009	0	
0.009	0.010	2	.XXXXXXXXXXXXXXXXXXXXXX
0.010	0.011	1	.XXXXXXXXXXX
0.011	0.012	0	
0.012	0.013	0	
0.013	0.014	0	
0.014	0.015	0	
0.015	0.016	0	
0.016	0.017	0	
0.017	0.018	0	
0.018	0.019	0	
0.019	0.020	0	
0.020	0.021	1	.XXXXXXXXXXX
0.021	0.022	0	
0.022	0.023	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.023	0.024	1	.XXXXXXXXXXX
0.024	0.025	1	.XXXXXXXXXXX
0.025	0.026	0	
0.026	0.027	1	.XXXXXXXXXXX
0.027	0.028	0	
0.028	0.029	0	
0.029	0.030	0	
0.030	0.031	0	
0.031	0.032	0	
0.032	0.033	0	
0.033	0.034	0	
0.034	0.035	1	.XXXXXXXXXXX

TABLE XXXIV

INITIAL CAPACITIES

SCS-301C473K **250 HOURS**

```
F DATA POINTS     50  MINIMUM      0.0434  #   50  MAXIMUM      0.0478  #   33   MEDIAN      0.0453
AN VALUE     0.0454   STANDARD DEVIATION     0.0011
ROM    TO     COUNT
0.043   0.043   1   .XXXXXXXXXXXXX
0.043   0.044   0
0.044   0.044   1   .XXXXXXXXXXXXX
0.044   0.044   5   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044   0.044   2   .XXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044   0.044   6   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044   0.045   2   .XXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045   0.045   3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045   0.045   4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045   0.045   1   .XXXXXXXXXXXXX
0.045   0.045   2   .XXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045   0.046   0
0.046   0.046   4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.046   0.046   7   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.046   0.046   0
0.046   0.046   1   .XXXXXXXXXXXXX
0.046   0.047   1   .XXXXXXXXXXXXX
0.047   0.047   4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.047   0.047   4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.047   0.047   0
0.047   0.047   1   .XXXXXXXXXXXXX
0.047   0.048   0
0.048   0.048   1   .XXXXXXXXXXXXX
```

TABLE XXXIV

FINAL CAPACITIES

SCS-301C473K **250 HOURS**

OF DATA POINTS 50 MINIMUM 0.0432 # 23 MAXIMUM 0.0477 # 33 MEDIAN 0.0453
MEAN VALUE 0.0452 STANDARD DEVIATION 0.0012

FROM	TO	COUNT
0.043	0.043	1
0.043	0.043	1
0.043	0.044	1
0.044	0.044	3
0.044	0.044	5
0.044	0.044	1
0.044	0.044	6
0.044	0.045	2
0.045	0.045	1
0.045	0.045	3
0.045	0.045	0
0.045	0.045	4
0.045	0.046	0
0.046	0.046	3
0.046	0.046	3
0.046	0.046	0
0.046	0.046	3
0.046	0.047	0
0.047	0.047	2
0.047	0.047	5
0.047	0.047	0
0.047	0.047	0
0.047	0.048	0
0.048	0.048	1

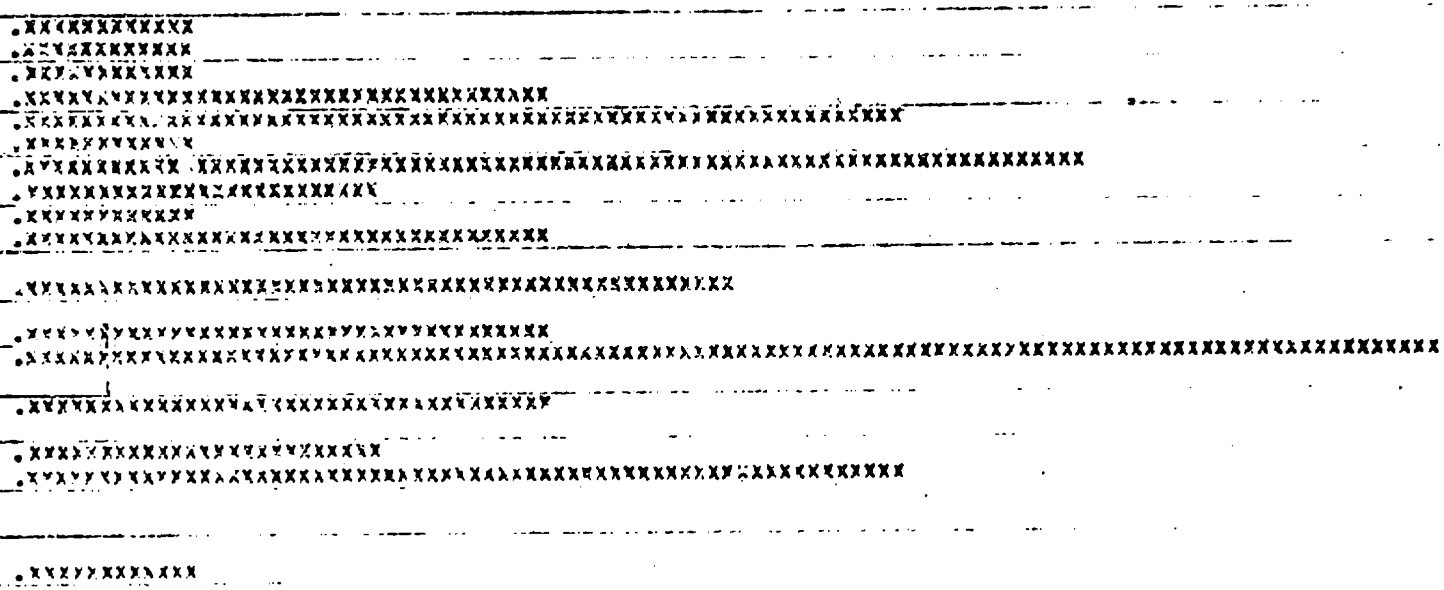


TABLE XXXIV

DELTA CAPACITIES

SCS-301C473K **250 HOURS**

DATA POINTS	50	MINIMUM	0.0000	#	12	MAXIMUM	0.0023	#	19	MEDIAN 0.0001
MEAN VALUE	0.0002	STANDARD DEVIATION	0.0004							

FROM	TO	COUNT	
0.000	0.000	29	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.000	0.000	2	.XXXXXX
0.000	0.000	11	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.000	0.000	4	.XXXXXXXXXXXX
0.001	0.001	0	
0.001	0.001	0	
0.001	0.001	1	.XXX
0.001	0.001	1	.XXX
0.001	0.001	1	.XXX
0.001	0.001	0	
0.001	0.001	0	
0.001	0.001	0	
0.001	0.001	0	
0.001	0.001	0	
0.001	0.002	0	
0.002	0.002	0	
0.002	0.002	0	
0.002	0.002	0	
0.002	0.002	0	
0.002	0.002	0	
0.002	0.002	0	
0.002	0.002	0	
0.002	0.002	1	.XXX

TABLE XXXIV

INITIAL CAPACITIES

SCS-301C334K **250 HOURS**

NO. OF DATA POINTS 50 MINIMUM 0.3009 # 36 MAXIMUM 0.3526 # 17 MEDIAN 0.3272
MEAN VALUE 0.3279 STANDARD DEVIATION 0.0116

FROM	TO	COUNT	
0.300	0.302	1	.XXXXXXXXXXXX
0.302	0.304	0	
0.304	0.306	0	
0.306	0.308	2	.XXXXXXXXXXXXXXXXXXXXXXXX
0.308	0.310	0	
0.310	0.312	0	
0.312	0.314	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.314	0.316	0	
0.316	0.318	1	.XXXXXXXXXXXX
0.318	0.320	9	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.320	0.322	1	.XXXXXXXXXXXX
0.322	0.324	6	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.324	0.326	0	
0.326	0.328	6	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.328	0.330	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.330	0.332	0	
0.332	0.334	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.334	0.336	1	.XXXXXXXXXXXX
0.336	0.338	2	.XXXXXXXXXXXXXXXXXXXXXXXX
0.338	0.340	1	.XXXXXXXXXXXX
0.340	0.342	0	
0.342	0.344	6	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.344	0.346	0	
0.346	0.348	1	.XXXXXXXXXXXX
0.348	0.350	1	.XXXXXXXXXXXX
0.350	0.352	0	
0.352	0.354	1	.XXXXXXXXXXXX

TABLE XXXIV

FINAL CAPACITIES

SCS-301C334K 250 HOURS

OF DATA POINTS 50 MINIMUM 0.3062 # 35 MAXIMUM 0.3524 # 19 MEDIAN 0.3266
MEAN VALUE 0.3277 STANDARD DEVIATION 0.0111

FROM	TO	COUNT	
0.306	0.308	2	.XXXXXXXXXXXXXXXXXXXX
0.308	0.310	1	.XXXXXXXXXX
0.310	0.312	0	
0.312	0.314	2	.XXXXXXXXXXXXXXXXXXXX
0.314	0.316	0	
0.316	0.318	2	.XXXXXXXXXXXXXXXXXXXX
0.318	0.320	13	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.320	0.322	0	
0.322	0.324	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.324	0.326	1	.XXXXXXXXXX
0.326	0.328	7	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.328	0.330	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.330	0.332	0	
0.332	0.334	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.334	0.336	0	
0.336	0.338	2	.XXXXXXXXXXXXXXXXXXXX
0.338	0.340	1	.XXXXXXXXXX
0.340	0.342	0	
0.342	0.344	6	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.344	0.346	1	.XXXXXXXXXX
0.346	0.348	0	
0.348	0.350	1	.XXXXXXXXXX
0.350	0.352	0	
0.352	0.354	1	.XXXXXXXXXX

TABLE XXXIV

DELTA CAPACITIES

SCS-301C334K 250 HOURS

DATA POINTS 50 MINIMUM 0.0000 # 8 MAXIMUM 0.0220 # 36 MEDIAN 0.0006

MEAN VALUE 0.0012 STANDARD DEVIATION 0.0031

FROM	TO	COUNT	
0.000	0.001	37	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.002	2	.XXXXX
0.002	0.003	10	.XXXXXXXXXXXXXXXXXXXXXXXXX
0.003	0.004	0	
0.004	0.005	0	
0.005	0.006	0	
0.006	0.007	0	
0.007	0.008	0	
0.008	0.009	0	
0.009	0.010	0	
0.010	0.011	0	
0.011	0.012	0	
0.012	0.013	0	
0.013	0.014	0	
0.014	0.015	0	
0.015	0.016	0	
0.016	0.017	0	
0.017	0.018	0	
0.018	0.019	0	
0.019	0.020	0	
0.020	0.021	0	
0.021	0.022	1	.XX

TABLE XXXIV

INITIAL CAPACITIES

SCS-301C105K **250 HOURS**

NO. DATA POINTS 50 MINIMUM 0.9287 # 43 MAXIMUM 1.0372 # 30 MEDIAN 0.9793
MEAN VALUE 0.9796 STANDARD DEVIATION 0.0235

FROM	TO	COUNT	
0.925	0.930	1	.XXXXXXXXXXXXXX
0.930	0.935	0	
0.935	0.940	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.940	0.945	0	
0.945	0.950	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.950	0.955	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.955	0.960	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.960	0.965	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.965	0.970	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.970	0.975	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.975	0.980	6	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.980	0.985	7	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.985	0.990	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.990	0.995	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.995	1.000	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.000	1.005	0	
1.005	1.010	1	.XXXXXXXXXXXXXX
1.010	1.015	1	.XXXXXXXXXXXXXX
1.015	1.020	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.020	1.025	0	
1.025	1.030	0	
1.030	1.035	1	.XXXXXXXXXXXXXX
1.035	1.040	1	.XXXXXXXXXXXXXX

TABLE XXXIV

FINAL CAPACITIES

SCS-301C105K **250 HOURS**

OF DATA POINTS 50 MINIMUM 0.9271 @ 43 MAXIMUM 1.0339 @ 30 MEDIAN 0.9777
MEAN VALUE 0.9780 STANDARD DEVIATION 0.0232

FROM	TO	COUNT	
0.925	0.930	1	.XXXXXXXXXXXXXXXX
0.930	0.935	0	
0.935	0.940	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.940	0.945	0	
0.945	0.950	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.950	0.955	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.955	0.960	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.960	0.965	1	.XXXXXXXXXXXXXXXX
0.965	0.970	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.970	0.975	6	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.975	0.980	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.980	0.985	6	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.985	0.990	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.990	0.995	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.995	1.000	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.000	1.005	1	.XXXXXXXXXXXXXXXX
1.005	1.010	1	.XXXXXXXXXXXXXXXX
1.010	1.015	1	.XXXXXXXXXXXXXXXX
1.015	1.020	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.020	1.025	0	
1.025	1.030	0	
1.030	1.035	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

TABLE XXXIV

DELTA CAPACITIES

SCS-301C105K 250 HOURS

```
# DATA POINTS      50  MINIMUM       0.0001  #    23  MAXIMUM        0.0127  #    6    MEDIAN       0.0015
AV VALUE      0.0022   STANDARD DEVIATION      0.0023
FROM    TO     COUNT
 0.000   0.001  11  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.001   0.001   8  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.001   0.002   7  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.002   0.002   8  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.002   0.003   1  .XXXXXXXXX
 0.003   0.003   1  .XXXXXXXXX
 0.003   0.004   3  .XXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.004   0.004   4  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.004   0.005   2  .XXXXXXXXXXXXXXXXXXX
 0.005   0.005   1  .XXXXXXXXX
 0.005   0.006   2  .XXXXXXXXXXXXXXXXXXX
 0.006   0.006   0
 0.006   0.007   0
 0.007   0.007   0
 0.007   0.008   0
 0.008   0.008   0
 0.008   0.009   0
 0.009   0.009   0
 0.009   0.010   1  .XXXXXXXXX
 0.010   0.010   0
 0.010   0.011   0
 0.011   0.011   0
 0.011   0.012   0
 0.012   0.012   0
 0.012   0.013   0
 0.013   0.013   1  .XXXXXXXXX
```

TABLE XXXIV

INITIAL CAPACITIES

SCS-301B104K 2000 HOURS

OF DATA POINTS 49 MINIMUM 0.0938 # 34 MAXIMUM 0.1084 # 19 MEDIAN 0.1020
MEAN VALUE 0.1010 STANDARD DEVIATION 0.0037

FROM	TO	COUNT	
0.094	0.094	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.094	0.095	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.095	0.095	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.095	0.096	1	.XXXXXXXXXXXXXXXX
0.096	0.096	0	
0.096	0.096	0	
0.096	0.097	0	
0.097	0.097	1	.XXXXXXXXXXXXXXXX
0.097	0.098	1	.XXXXXXXXXXXXXXXX
0.098	0.098	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.098	0.099	0	
0.099	0.099	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.099	0.100	0	
0.100	0.100	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.100	0.101	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.101	0.101	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.101	0.102	0	
0.102	0.102	6	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.102	0.103	1	.XXXXXXXXXXXXXXXX
0.103	0.103	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.103	0.104	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.104	0.104	1	.XXXXXXXXXXXXXXXX
0.104	0.105	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.105	0.105	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.105	0.106	1	.XXXXXXXXXXXXXXXX
0.106	0.106	1	.XXXXXXXXXXXXXXXX
0.106	0.107	0	
0.107	0.107	0	
0.107	0.108	0	
0.108	0.108	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

TABLE XXXIV

FINAL CAPACITIES

SCS-301B104K **2000 HOURS**

```
# DATA POINTS      49   MINIMUM      0.0929  #   34  MAXIMUM      0.1060  #  14   MEDIAN      0.1004
AV VALUE      0.0996    STANDARD DEVIATION     0.0037
FROM   TO      COUNT
0.093      0.093    2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.093      0.094    1   .XXXXXXXXXXXXXXXXXXXX
0.094      0.094    4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.094      0.095    1   .XXXXXXXXXXXXXXXXXXXX
0.095      0.095    1   .XXXXXXXXXXXXXXXXXXXX
0.095      0.095    0
0.095      0.096    2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.096      0.096    2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.096      0.097    0
0.097      0.097    0
0.097      0.098    1   .XXXXXXXXXXXXXXXXXXXX
0.098      0.098    1   .XXXXXXXXXXXXXXXXXXXX
0.098      0.099    1   .XXXXXXXXXXXXXXXXXXXX
0.099      0.099    5   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.099      0.100    3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.100      0.100    1   .XXXXXXXXXXXXXXXXXXXX
0.100      0.101    4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.101      0.101    2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.101      0.102    3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.102      0.102    5   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.102      0.103    1   .XXXXXXXXXXXXXXXXXXXX
0.103      0.103    2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.103      0.104    1   .XXXXXXXXXXXXXXXXXXXX
0.104      0.104    4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.104      0.105    0
0.105      0.105    0
0.105      0.106    1   .XXXXXXXXXXXXXXXXXXXX
0.106      0.106    1   .XXXXXXXXXXXXXXXXXXXX
```

TABLE XXXIV

DELTA CAPACITIES

SCS-301B104K **2000 HOURS**

DATA POINTS 49 MINIMUM 0.0002 # 17 MAXIMUM 0.0030 # 37 MEDIAN 0.0012

N VALUE 0.0013 STANDARD DEVIATION 0.0007

FROM	TO	COUNT	
0.000	0.000	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.000	0.000	0	
0.000	0.000	1	.XXXXXXXXXXXXXX
0.000	0.001	0	
0.001	0.001	1	.XXXXXXXXXXXXXX
0.001	0.001	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.001	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.001	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.001	7	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.001	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.001	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.001	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.001	1	.XXXXXXXXXXXXXX
0.001	0.002	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.002	0.002	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.002	0.002	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.002	0.002	0	
0.002	0.002	0	
0.002	0.002	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.002	0.002	1	.XXXXXXXXXXXXXX
0.002	0.002	0	
0.002	0.002	1	.XXXXXXXXXXXXXX
0.002	0.002	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.002	0.003	0	
0.003	0.003	0	
0.003	0.003	0	
0.003	0.003	1	.XXXXXXXXXXXXXX
0.003	0.003	0	
0.003	0.003	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXX

TABLE XXXIV

INITIAL CAPACITIES

SCS-301B105K 2000 HOURS

```
POINTS      50  MINIMUM        0.9104  #    11  MAXIMUM        1.0830  #   43    MEDIAN        1.0054
ME      1.0019  STANDARD DEVIATION     0.0364
TO   COUNT
   0.920    1   .XXXXXXXXXXXXXX
   0.930    0
   0.940    2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.950    1   .XXXXXXXXXXXXXX
   0.960    2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.970    4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.980    5   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.990    5   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   1.000    2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXX
   1.010    7   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   1.020    6   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   1.030    5   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   1.040    5   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   1.050    0
   1.060    2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXX
   1.070    0
   1.080    2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXX
   1.090    1   .XXXXXXXXXXXXXX
```

TABLE XXXIV

FINAL CAPACITIES

SCS-301B105K **2000 HOURS**

DATA POINTS 50 MINIMUM 0.9032 # 11 MAXIMUM 1.0735 # 43 MEDIAN 0.9990
VALUE 0.9954 STANDARD DEVIATION 0.0373

FROM	TO	COUNT	
0.900	0.910	1	.XXXXXXXXXXXX
0.910	0.920	0	
0.920	0.930	1	.XXXXXXXXXXXX
0.930	0.940	1	.XXXXXXXXXXXX
0.940	0.950	2	.XXXXXXXXXXXXXXXXXXXXXXXX
0.950	0.960	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.960	0.970	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.970	0.980	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.980	0.990	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.990	1.000	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.000	1.010	8	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.010	1.020	6	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.020	1.030	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.030	1.040	2	.XXXXXXXXXXXXXXXXXXXXXXXX
1.040	1.050	0	
1.050	1.060	2	.XXXXXXXXXXXXXXXXXXXXXXXX
1.060	1.070	2	.XXXXXXXXXXXXXXXXXXXXXXXX
1.070	1.080	1	.XXXXXXXXXXXX

TABLE XXXIV

DELTA CAPACITIES

SCS-301B105K **2000 HOURS**

```
POINTS      50  MINIMUM      0.0005  #   42  MAXIMUM      0.0145  #   7   MEDIAN      0.0053
BF      0.0059   STANDARD DEVIATION      0.0036
TO   COUNT
   0.001   1   .XXXXXXXXXXXXXX
   0.001   3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.002   1   .XXXXXXXXXXXXXX
   0.002   2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.003   0
   0.003   1   .XXXXXXXXXXXXXX
   0.004   7   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.004   3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.005   4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.005   2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.006   3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.006   3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.007   6   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.007   0
   0.008   1   .XXXXXXXXXXXXXX
   0.008   0
   0.009   0
   0.009   1   .XXXXXXXXXXXXXX
   0.010   3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.010   2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.011   2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.011   1   .XXXXXXXXXXXXXX
   0.012   0
   0.012   0
   0.013   1   .XXXXXXXXXXXXXX
   0.013   0
   0.014   0
   0.014   1   .XXXXXXXXXXXXXX
   0.015   2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

TABLE XXXIV

INITIAL CAPACITIES

SCS-301B405K **2000 HOURS**

```
OF DATA POINTS     50  MINIMUM        3.7320  #     16  MAXIMUM       4.1850  #   48    MEDIAN       3.9860
RAW VALUE      3.9706    STANDARD DEVIATION       0.1077
FROM    TO      COUNT
 3.720   3.740    2   .XXXXXXXXXXXXXXXXXXXXXXXX
 3.740   3.760    0
 3.760   3.780    1   .XXXXXXXXXXXX
 3.780   3.800    3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 3.800   3.820    0
 3.820   3.840    4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 3.840   3.860    0
 3.860   3.880    0
 3.880   3.900    1   .XXXXXXXXXXXX
 3.900   3.920    0
 3.920   3.940    8   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 3.940   3.960    0
 3.960   3.980    4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 3.980   4.000    6   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 4.000   4.020    2   .XXXXXXXXXXXXXXXXXXXXXXXX
 4.020   4.040    7   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 4.040   4.060    0
 4.060   4.080    3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 4.080   4.100    7   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 4.100   4.120    0
 4.120   4.140    1   .XXXXXXXXXXXX
 4.140   4.160    0
 4.160   4.180    0
 4.180   4.200    1   .XXXXXXXXXXXX
```

TABLE XXXIV

FINAL CAPACITIES

SCS-301B405K **2000 HOURS**

OF DATA POINTS 50 MINIMUM 3.7260 # 16 MAXIMUM 4.1360 # 48 MEDIAN 3.9500
MEAN VALUE 3.9665 STANDARD DEVIATION 0.1000

FROM	TO	COUNT	
3.720	3.740	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.740	3.760	0	
3.760	3.780	1	.XXXXXXXXXX
3.780	3.800	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.800	3.820	0	
3.820	3.840	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.840	3.860	0	
3.860	3.880	0	
3.880	3.900	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.900	3.920	0	
3.920	3.940	10	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.940	3.960	1	.XXXXXXXXXX
3.960	3.980	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.980	4.000	8	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.000	4.020	1	.XXXXXXXXXX
4.020	4.040	7	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.040	4.060	0	
4.060	4.080	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.080	4.100	1	.XXXXXXXXXX
4.100	4.120	0	
4.120	4.140	1	.XXXXXXXXXX

TABLE XXXIV

DELTA CAPACITIES

SCS-301B405K 2000 HOURS

```
F DATA POINTS       50  MINIMUM     0.0020  #    2  MAXIMUM     0.0520  #   48   MEDIAN      0.0295
AN VALUE      0.0262    STANDARD DEVIATION       0.0144
ROM     TO      COUNT
 0.000   0.002    1   .XXXXXXXXXXXXXXXXXXXX
 0.002   0.004    0
 0.004   0.006    2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.006   0.008    5   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.008   0.010    2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.010   0.012    3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.012   0.014    5   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.014   0.016    0
 0.016   0.018    1   .XXXXXXXXXXXXXXXXXXXX
 0.018   0.020    0
 0.020   0.022    0
 0.022   0.024    2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.024   0.026    1   .XXXXXXXXXXXXXXXXXXXX
 0.026   0.028    2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.028   0.030    2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.030   0.032    3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.032   0.034    4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.034   0.036    4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.036   0.038    4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.038   0.040    1   .XXXXXXXXXXXXXXXXXXXX
 0.040   0.042    1   .XXXXXXXXXXXXXXXXXXXX
 0.042   0.044    2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.044   0.046    1   .XXXXXXXXXXXXXXXXXXXX
 0.046   0.048    1   .XXXXXXXXXXXXXXXXXXXX
 0.048   0.050    1   .XXXXXXXXXXXXXXXXXXXX
 0.050   0.052    2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

TABLE XXXIV

INITIAL CAPACITIES

SCS-301C473K 2000 HOURS

OF DATA POINTS 50 MINIMUM 0.0437 # 29 MAXIMUM 0.0478 # 37 MEDIAN 0.0453

MEAN VALUE 0.0453 STANDARD DEVIATION 0.0010

FROM	TO	COUNT	
0.044	0.044	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.064	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.044	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.044	6	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.045	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.045	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.045	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.045	0	
0.045	0.045	8	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.046	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.046	0.046	6	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.046	0.046	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.046	0.046	1	.XXXXXXXXXXXXXXX
0.046	0.046	1	.XXXXXXXXXXXXXXX
0.046	0.047	0	
0.047	0.047	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.047	0.047	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.047	0.047	0	
0.047	0.047	0	
0.047	0.048	1	.XXXXXXXXXXXXXXX
0.047	0.048	1	.XXXXXXXXXXXXXXX

TABLE XXXIV

FINAL CAPACITIES

SCS-301C473K 2000 HOURS

# OF DATA POINTS	50	MINIMUM	0.0430	#	11	MAXIMUM	0.0469	#	48	MEDIAN	0.0449
MEAN VALUE	0.0448	STANDARD DEVIATION	0.0010								

FROM	TO	COUNT	
0.043	0.043	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.043	0.043	0	
0.043	0.043	0	
0.043	0.043	0	
0.043	0.043	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.043	0.044	0	
0.044	0.044	1	.XXXXXXXXXXXXXXXX
0.044	0.044	1	.XXXXXXXXXXXXXXXX
0.044	0.044	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.044	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.044	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.044	0	
0.044	0.044	0	
0.044	0.044	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.044	1	.XXXXXXXXXXXXXXXX
0.044	0.045	0	
0.045	0.045	0	
0.045	0.045	1	.XXXXXXXXXXXXXXXX
0.045	0.045	0	
0.045	0.045	6	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.045	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.045	1	.XXXXXXXXXXXXXXXX
0.045	0.045	0	
0.045	0.045	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.045	1	.XXXXXXXXXXXXXXXX
0.045	0.046	0	
0.046	0.046	1	.XXXXXXXXXXXXXXXX
0.046	0.046	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.046	0.046	1	.XXXXXXXXXXXXXXXX
0.046	0.046	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.046	0.046	1	.XXXXXXXXXXXXXXXX
0.046	0.046	1	.XXXXXXXXXXXXXXXX
0.046	0.046	0	
0.046	0.046	1	.XXXXXXXXXXXXXXXX
0.046	0.046	0	
0.046	0.047	0	
0.047	0.047	0	
0.047	0.047	1	.XXXXXXXXXXXXXXXX
0.047	0.047	1	.XXXXXXXXXXXXXXXX
0.047	0.047	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

TABLE XXXIV

DELTA CAPACITIES

SCS-301C473K 2000 HOURS

\# OF DATA POINTS 50 MINIMUM 0.0000 # 15 MAXIMUM 0.0022 # 42 MEDIAN 0.0005
MEAN VALUE 0.0007 STANDARD DEVIATION 0.0004

FROM	TO	COUNT	
0.000	0.000	2	.XXXXXXXXXXXXXXXXXXXXXXXXX
0.000	0.000	2	.XXXXXXXXXXXXXXXXXXXXXXXXX
0.000	0.000	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.000	0.000	8	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.000	0.001	8	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.001	2	.XXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.001	2	.XXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.001	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.001	7	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.001	8	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.001	1	.XXXXXXXXXXXX
0.001	0.001	1	.XXXXXXXXXXXX
0.001	0.001	0	
0.001	0.001	0	
0.001	0.002	0	
0.002	0.002	0	
0.002	0.002	0	
0.002	0.002	0	
0.002	0.002	0	
0.002	0.002	0	
0.002	0.002	0	
0.002	0.002	1	.XXXXXXXXXXXX

TABLE XXXIV

INITIAL CAPACITIES

SCS-301C334K 2000 HOURS

```
OF DATA POINTS       50  MINIMUM      0.2993  #    28  MAXIMUM     0.3434  #   2   MEDIAN     0.3239
MEAN VALUE       0.3246   STANDARD DEVIATION    0.0105
FROM    TO     COUNT
 0.298   0.300   2   .XXXXXXXXXXXXXXXXXXXXXXXX
 0.300   0.302   0
 0.302   0.304   0
 0.304   0.306   0
 0.306   0.308   0
 0.308   0.310   3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.310   0.312   0
 0.312   0.314   3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.314   0.316   0
 0.316   0.318   3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.318   0.320   8   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.320   0.322   0
 0.322   0.324   9   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.324   0.326   1   .XXXXXXXXXXXX
 0.326   0.328   3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.328   0.330   5   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.330   0.332   1   .XXXXXXXXXXXX
 0.332   0.334   4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.334   0.336   1   .XXXXXXXXXXXX
 0.336   0.338   2   .XXXXXXXXXXXXXXXXXXXXXXXX
 0.338   0.340   2   .XXXXXXXXXXXXXXXXXXXXXXXX
 0.340   0.342   0
 0.342   0.344   4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

TABLE XXXIV

FINAL CAPACITIES

SCS-301C334K **2000 HOURS**

```
NO DATA POINTS    50  MINIMUM      0.2862  #   28  MAXIMUM      0.3399  #   2   MEDIAN      0.3223
MEAN VALUE    0.3214    STANDARD DEVIATION     0.0111
FROM     TO     COUNT
 0.286   0.288    1   .XXXXXXXXXXXX
 0.288   0.290    0
 0.290   0.292    0
 0.292   0.294    0
 0.294   0.296    0
 0.296   0.298    0
 0.298   0.300    1   .XXXXXXXXXXXX
 0.300   0.302    0
 0.302   0.304    2   .XXXXXXXXXXXXXXXXXXXXXXXX
 0.304   0.306    0
 0.306   0.308    0
 0.308   0.310    3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.310   0.312    0
 0.312   0.314    8   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.314   0.316    0
 0.316   0.318    1   .XXXXXXXXXXXX
 0.318   0.320    7   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.320   0.322    1   .XXXXXXXXXXXX
 0.322   0.324    8   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.324   0.326    0
 0.326   0.328    1   .XXXXXXXXXXXX
 0.328   0.330    7   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.330   0.332    1   .XXXXXXXXXXXX
 0.332   0.334    4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.334   0.336    0
 0.336   0.338    1   .XXXXXXXXXXXX
 0.338   0.340    4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

TABLE XXXIV

DELTA CAPACITIES

SCS-301C334K **2000 HOURS**

```
# OF DATA POINTS      50  MINIMUM      0.0006  #    13  MAXIMUM      0.0131  #   28    MEDIAN       0.0032
MEAN VALUE       0.0032   STANDARD DEVIATION      0.0021
 FROM     TO      COUNT
  0.001    0.001    5    .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  0.001    0.002    7    .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  0.002    0.002    5    .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  0.002    0.003    1    .XXXXXXXXXXXXX
  0.003    0.003    3    .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  0.003    0.004    7    .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  0.004    0.004    6    .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  0.004    0.005    4    .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  0.005    0.005    7    .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  0.005    0.006    1    .XXXXXXXXXXXXX
  0.006    0.006    1    .XXXXXXXXXXXXX
  0.006    0.007    1    .XXXXXXXXXXXXX
  0.007    0.007    0
  0.007    0.008    0
  0.008    0.008    0
  0.008    0.009    0
  0.009    0.009    0
  0.009    0.010    0
  0.010    0.010    0
  0.010    0.011    0
  0.011    0.011    0
  0.011    0.012    0
  0.012    0.012    0
  0.012    0.013    0
  0.013    0.013    0
  0.013    0.014    1    .XXXXXXXXXXXXX
```

TABLE XXXIV

INITIAL CAPACITIES

SCS-301C105K 2000 HOURS

```
F DATA POINTS      50  MINIMUM      0.9203  #   43  MAXIMUM      1.0965  #   28    MEDIAN      0.9518
AN VALUE      0.9697   STANDARD DEVIATION      0.0434
FROM    TO      COUNT
 0.920    0.930    4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.930    0.940   10   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.940    0.950   10   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.950    0.960    6   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.960    0.970    4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.970    0.980    2   .XXXXXXXXXXXXXXXXXXXX
 0.980    0.990    2   .XXXXXXXXXXXXXXXXXXXX
 0.990    1.000    0
 1.000    1.010    3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 1.010    1.020    1   .XXXXXXXXXX
 1.020    1.030    1   .XXXXXXXXXX
 1.030    1.040    2   .XXXXXXXXXXXXXXXXXXXX
 1.040    1.050    1   .XXXXXXXXXX
 1.050    1.060    0
 1.060    1.070    3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 1.070    1.080    0
 1.080    1.090    0
 1.090    1.100    1   .XXXXXXXXXX
```

TABLE XXXIV

FINAL CAPACITIES

SCS-301C105K 2000 HOURS

```
OF DATA POINTS      50  MINIMUM     0.9139  #   30  MAXIMUM     1.0821  #   28   MEDIAN     0.9437
MAP VALUE      0.9615   STANDARD DEVIATION    0.0421
FROM     TO     COUNT
  0.913   0.920    2   .XXXXXXXXXXXXXXXX
  0.920   0.930    9   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  0.930   0.940   12   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  0.940   0.950    8   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  0.950   0.960    3   .XXXXXXXXXXXXXXXXXXXXXXXX
  0.960   0.970    1   .XXXXXXXX
  0.970   0.980    3   .XXXXXXXXXXXXXXXXXXXXXXXX
  0.980   0.990    0
  0.990   1.000    3   .XXXXXXXXXXXXXXXXXXXXXXXX
  1.000   1.010    2   .XXXXXXXXXXXXXXXX
  1.010   1.320    0
  1.020   1.030    1   .XXXXXXXX
  1.030   1.040    2   .XXXXXXXXXXXXXXXX
  1.040   1.050    0
  1.050   1.060    3   .XXXXXXXXXXXXXXXXXXXXXXXX
  1.050   1.070    0
  1.370   1.080    0
  1.080   1.093    1   .XXXXXXXX
```

TABLE XXXIV

DELTA CAPACITIES

SCS-301C105K 2000 HOURS

OF DATA POINTS 50 MINIMUM 0.0010 # 41 MAXIMUM 0.0147 # 40 MEDIAN 0.0095
AN VALUE 0.0081 STANDARD DEVIATION 0.0032

FROM	TO	COUNT	
0.001	0.001	1	.XXXXXXXXXXX
0.001	0.002	2	.XXXXXXXXXXXXXXXXXXXXXX
0.002	0.002	2	.XXXXXXXXXXXXXXXXXXXXXX
0.002	0.003	0	
0.003	0.003	0	
0.003	0.004	1	.XXXXXXXXXXX
0.004	0.004	0	
0.004	0.005	0	
0.005	0.005	1	.XXXXXXXXXXX
0.005	0.006	2	.XXXXXXXXXXXXXXXXXXXXXX
0.006	0.006	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.006	0.007	1	.XXXXXXXXXXX
0.007	0.007	2	.XXXXXXXXXXXXXXXXXXXXXX
0.007	0.008	2	.XXXXXXXXXXXXXXXXXXXXXX
0.008	0.008	1	.XXXXXXXXXXX
0.008	0.009	1	.XXXXXXXXXXX
0.009	0.009	1	.XXXXXXXXXXX
0.009	0.010	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.010	0.010	9	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.010	0.011	7	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.011	0.011	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.011	0.012	0	
0.012	0.012	0	
0.012	0.013	1	.XXXXXXXXXXX
0.013	0.013	1	.XXXXXXXXXXX
0.013	0.014	0	
0.014	0.014	0	
0.014	0.015	1	.XXXXXXXXXXX
0.015	0.015	1	.XXXXXXXXXXX

TABLE XXXIV

INITIAL CAPACITIES

SCS-301B108K 4000 HOURS

```
# DATA POINTS      49   MINIMUM      0.0920 #    21   MAXIMUM     0.1070 #   19    MEDIAN      0.0979
MEAN VALUE     0.0978   STANDARD DEVIATION    0.0033
FROM    TO      COUNT
0.092   0.092     1   .XXXXXXXXXXXXXXXXXXX
0.092   0.093     1   .XXXXXXXXXXXXXXXXXXX
0.093   0.093     3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.093   0.094     1   .XXXXXXXXXXXXXXXXXXX
0.094   0.094     2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.094   0.095     2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.095   0.095     1   .XXXXXXXXXXXXXXXXXXX
0.095   0.095     1   .XXXXXXXXXXXXXXXXXXX
0.095   0.096     2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.096   0.096     4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.096   0.097     1   .XXXXXXXXXXXXXXXXXXX
0.097   0.097     5   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.097   0.098     1   .XXXXXXXXXXXXXXXXXXX
0.098   0.098     5   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.098   0.099     1   .XXXXXXXXXXXXXXXXXXX
0.099   0.099     5   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.099   0.100     2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.100   0.100     3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.100   0.101     1   .XXXXXXXXXXXXXXXXXXX
0.101   0.101     0
0.101   0.102     0
0.102   0.102     2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.102   0.103     1   .XXXXXXXXXXXXXXXXXXX
0.103   0.103     2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.1     0.104     0
0.104   0.104     1   .XXXXXXXXXXXXXXXXXXX
0.104   0.105     0
0.105   0.105     0
0.105   0.106     0
0.106   0.106     0
0.106   0.107     0
0.107   0.107     1   .XXXXXXXXXXXXXXXXXXX
```

TABLE XXXIV

FINAL CAPACITIES

SCS-301B104K 4000 HOURS

OF DATA POINTS 49 MINIMUM 0.0908 # 21 MAXIMUM 0.1029 # 19 MEDIAN 0.0963
MEAN VALUE 0.0965 STANDARD DEVIATION 0.0030

FROM	TO	COUNT	
0.091	0.091	1	.XXXXXXXXXXXXXXXX
0.091	0.092	1	.XXXXXXXXXXXXXXXX
0.092	0.092	1	.XXXXXXXXXXXXXXXX
0.092	0.093	0	
0.093	0.093	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.093	0.093	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.093	0.094	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.094	0.094	1	.XXXXXXXXXXXXXXXX
0.094	0.095	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.095	0.095	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.095	0.096	1	.XXXXXXXXXXXXXXXX
0.096	0.096	6	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.096	0.097	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.097	0.097	1	.XXXXXXXXXXXXXXXX
0.097	0.098	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.098	0.098	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.098	0.099	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.099	0.099	1	.XXXXXXXXXXXXXXXX
0.099	0.100	1	.XXXXXXXXXXXXXXXX
0.100	0.100	1	.XXXXXXXXXXXXXXXX
0.100	0.101	1	.XXXXXXXXXXXXXXXX
0.101	0.101	1	.XXXXXXXXXXXXXXXX
0.101	0.102	0	
0.102	0.102	1	.XXXXXXXXXXXXXXXX
0.102	0.103	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

TABLE XXXIV

DELTA CAPACITIES

SCS-301B104K **4000 HOURS**

DATA POINTS 49 MINIMUM 0.0000 # 12 MAXIMUM 0.0041 # 19 MEDIAN 0.0010

AN VALUE 0.0013 STANDARD DEVIATION 0.0009

OM	TO	COUNT	
0.000	0.000	2	.XXXXXXXXXXXXXXXXXXXX
0.000	0.000	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.000	0.001	10	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.001	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.001	6	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.001	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.001	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.002	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.002	0.002	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.002	0.002	2	.XXXXXXXXXXXXXXXXXXXX
0.002	0.002	1	.XXXXXXXXXX
0.002	0.002	0	
0.002	0.003	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.003	0.003	0	
0.003	0.003	0	
0.003	0.003	0	
0.003	0.003	1	.XXXXXXXXXX
0.003	0.004	1	.XXXXXXXXXX
0.004	0.004	0	
0.004	0.004	0	
0.004	0.004	1	.XXXXXXXXXX

TABLE XXXIV

INITIAL CAPACITIES

SCS-301B105K **4000 HOURS**

OF DATA POINTS 50 MINIMUM 0.9720 # 21 MAXIMUM 1.0685 # 48 MEDIAN 0.9814
MEAN VALUE 0.9845 STANDARD DEVIATION 0.0341

FROM	TO	COUNT	
0.920	0.925	1	.XXXXXXXXXXXXXXX
0.925	0.930	1	.XXXXXXXXXXXXXXX
0.930	0.935	0	
0.935	0.940	1	.XXXXXXXXXXXXXXX
0.940	0.945	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.945	0.950	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.950	0.955	0	
0.955	0.960	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.960	0.965	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.965	0.970	6	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.970	0.975	0	
0.975	0.980	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.980	0.985	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.985	0.990	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.990	0.995	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.995	1.000	6	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.000	1.005	1	.XXXXXXXXXXXXXXX
1.005	1.010	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.010	1.015	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.015	1.020	1	.XXXXXXXXXXXXXXX
1.020	1.025	1	.XXXXXXXXXXXXXXX
1.025	1.030	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.030	1.035	0	
1.035	1.040	0	
1.040	1.045	1	.XXXXXXXXXXXXXXX
1.045	1.050	1	.XXXXXXXXXXXXXXX
1.050	1.055	0	
1.055	1.060	0	
1.060	1.065	0	
1.065	1.070	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

TABLE XXXIV

FINAL CAPACITIES

SCS-301B105K **4000 HOURS**

```
# DATA POINTS      50  MINIMUM     0.9176  #    21  MAXIMUM     1.0590  #     7   MEDIAN     0.9734
MEAN VALUE     0.9779  STANDARD DEVIATION    0.0350
FROM    TO     COUNT
 0.915   0.920   1   .XXXXXXXXXXXXXX
 0.920   0.925   1   .XXXXXXXXXXXXXX
 0.925   0.930   1   .XXXXXXXXXXXXXX
 0.930   0.935   0
 0.935   0.940   7   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.940   0.945   2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.945   0.950   1   .XXXXXXXXXXXXXX
 0.950   0.955   2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.955   0.960   3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.960   0.965   3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.965   0.970   4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.970   0.975   0
 0.975   0.980   2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.980   0.985   3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.985   0.990   4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.990   0.995   2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.995   1.000   3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 1.000   1.005   2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXX
 1.005   1.010   2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXX
 1.010   1.015   1   .XXXXXXXXXXXXXX
 1.015   1.020   0
 1.020   1.025   0
 1.025   1.030   2   .XXXXXXXXXXXXXXXXXXXXXXXXXXXX
 1.030   1.035   0
 1.035   1.040   1   .XXXXXXXXXXXXXX
 1.040   1.045   1   .XXXXXXXXXXXXXX
 1.045   1.050   0
 1.050   1.055   1   .XXXXXXXXXXXXXX
 1.055   1.060   0
 1.060   1.065   0
 1.065   1.070   1   .XXXXXXXXXXXXXX
```

TABLE XXXIV

DELTA CAPACITIES

SCS-301B105K 4000 HOURS

OF DATA POINTS 50 MINIMUM 0.0001 # 10 MAXIMUM 0.0176 # 49 MEDIAN 0.0071
MEAN VALUE 0.0074 STANDARD DEVIATION 0.0049

FROM	TO	COUNT	
0.000	0.001	8	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.002	1	.XXXXXXXXXXXX
0.002	0.003	0	
0.003	0.004	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.004	0.005	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.005	0.006	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.006	0.007	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.007	0.008	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.008	0.009	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.009	0.010	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.010	0.011	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.011	0.012	2	.XXXXXXXXXXXXXXXXXXXXXXXX
0.012	0.013	0	
0.013	0.014	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.014	0.015	1	.XXXXXXXXXXXX
0.015	0.016	1	.XXXXXXXXXXXX
0.016	0.017	2	.XXXXXXXXXXXXXXXXXXXXXXXX
0.017	0.018	1	.XXXXXXXXXXXX

TABLE XXXIV

INITIAL CAPACITIES

SCS-301B405K 4000 HOURS

NO. DATA POINTS 50 MINIMUM 3.6300 # 30 MAXIMUM 4.1280 # 18 MEDIAN 3.9145
MEAN VALUE [illegible] STANDARD DEVIATION 0.1010

FROM	TO	COUNT
3.620	3.640	1
3.640	3.660	0
3.660	3.680	0
3.680	3.700	0
3.700	3.720	0
3.720	3.740	1
3.740	3.760	1
3.760	3.780	1
3.780	3.800	4
3.800	3.820	0
3.820	3.840	4
3.840	3.860	1
3.860	3.880	5
3.880	3.900	6
3.900	3.920	1
3.920	3.940	5
3.940	3.960	1
3.960	3.980	3
3.980	4.000	9
4.000	4.020	1
4.020	4.040	2
4.040	4.060	0
4.060	4.080	2
4.080	4.100	1
4.100	4.120	0
4.120	4.140	1

TABLE XXXIV

FINAL CAPACITIES

SCS-301B405K **4000 HOURS**

DATA POINTS 50 MINIMUM 3.5930 # 30 MAXIMUM 4.0850 # 18 MEDIAN 3.8540
MEAN VALUE 3.8696 STANDARD DEVIATION 0.1019

FROM	TO	COUNT	
3.580	3.600	1	.XXXXXXXX
3.600	3.620	0	
3.620	3.640	0	
3.640	3.660		
3.660	3.680	0	
3.680	3.700	1	.XXXXXXXX
3.700	3.720	0	
3.720	3.740	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.740	3.760	0	
3.760	3.780	3	.XXXXXXXXXXXXXXXXXXXXXXXX
3.780	3.800	3	.XXXXXXXXXXXXXXXXXXXXXXXX
3.800	3.820	0	
3.820	3.840	12	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.840	3.860	0	
3.860	3.880	1	.XXXXXXXX
3.880	3.900	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.900	3.920	0	
3.920	3.940	7	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.940	3.960	1	.XXXXXXXX
3.960	3.980	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.980	4.000	2	.XXXXXXXXXXXXXXXX
4.000	4.020	0	
4.020	4.040	2	.XXXXXXXXXXXXXXXX
4.040	4.060	0	
4.060	4.080	1	.XXXXXXXX
4.080	4.100	1	.XXXXXXXX

TABLE XXXIV

DELTA CAPACITIES

SCS-301B405K **4000 HOURS**

OF DATA POINTS 50 MINIMUM 0.0210 # 34 MAXIMUM 0.0700 # 9 MEDIAN 0.0455
MEAN VALUE 0.0[illegible] STANDARD DEVIATION 0.0122

FROM	TO	COUNT	
0.020	0.022	1	.XXXXXXXXXXX
0.022	0.024	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.024	0.026	1	.XXXXXXXXXXX
0.026	0.028	0	
0.028	0.030	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.030	0.032	7	.XXXXXXXXXXXXXXXXXXXXXXX
0.032	0.034	0	
0.034	0.036	1	.XXXXXXXXXXX
0.036	0.038	2	.XXXXXXXXXXXXXXXXXXXXXXX
0.038	0.040	1	.XXXXXXXXXXX
0.040	0.042	8	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.042	0.044	2	.XXXXXXXXXXXXXXXXXXXXXXX
0.044	0.046	2	.XXXXXXXXXXXXXXXXXXXXXXX
0.046	0.048	2	.XXXXXXXXXXXXXXXXXXXXXXX
0.048	0.050	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.050	0.052	1	.XXXXXXXXXXX
0.052	0.054	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.054	0.056	0	
0.056	0.058	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.058	0.060	1	.XXXXXXXXXXX
0.060	0.062	0	
0.062	0.064	1	.XXXXXXXXXXX
0.064	0.066	0	
0.066	0.068	1	.XXXXXXXXXXX
0.068	0.070	1	.XXXXXXXXXXX
0.070	0.072	1	.XXXXXXXXXXX

TABLE XXXIV

INITIAL CAPACITIES

SCS-301C473K **4000 HOURS**

OF DATA POINTS 50 MINIMUM 0.0438 # 46 MAXIMUM 0.0473 # 34 MEDIAN 0.0452
MEAN VALUE 0.0452 STANDARD DEVIATION 0.0009

FROM	TO	COUNT	
0.044	0.044	1	.XXXXXXXXXXXXXXXXXXXX
0.044	0.044	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.044	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.044	0	
0.044	0.044	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.044	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.044	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.045	0	
0.045	0.045	0	
0.045	0.045	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.045	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.045	1	.XXXXXXXXXXXXXXXXXXXX
0.045	0.045	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.045	0	
0.045	0.045	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.045	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.045	1	.XXXXXXXXXXXXXXXXXXXX
0.045	0.046	0	
0.046	0.046	0	
0.046	0.046	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.046	0.046	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.046	0.046	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.046	0.046	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.046	0.046	1	.XXXXXXXXXXXXXXXXXXXX
0.046	0.046	0	
0.046	0.046	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.046	0.046	0	
0.046	0.047	0	
0.047	0.047	0	
0.047	0.047	1	.XXXXXXXXXXXXXXXXXXXX
0.047	0.047	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.047	0.047	0	
0.047	0.047	0	
0.047	0.047	0	
0.047	0.047	0	
0.047	0.047	1	.XXXXXXXXXXXXXXXXXXXX

TABLE XXXIV

FINAL CAPACITIES

SCS-301C473K **4000 HOURS**

NO DATA POINTS 50 MINIMUM 0.0433 # 46 MAXIMUM 0.0466 # 34 MEDIAN 0.0448
MEAN VALUE 0.0447 STANDARD DEVIATION 0.0009

FROM	TO	COUNT	
0.043	0.043	1	.XXXXXXXXXXXXXX
0.043	0.043	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.043	0.044	0	
0.044	0.044	0	
0.044	0.044	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.044	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.044	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.044	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.044	0	
0.044	0.044	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.044	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.044	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.045	0	
0.045	0.045	0	
0.045	0.045	1	.XXXXXXXXXXXXXX
0.045	0.045	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.045	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.045	0	
0.045	0.045	0	
0.045	0.045	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.045	7	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.045	0	
0.045	0.046	0	
0.046	0.046	1	.XXXXXXXXXXXXXX
0.046	0.046	1	.XXXXXXXXXXXXXX
0.046	0.046	0	
0.046	0.046	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.046	0.046	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.046	0.046	0	
0.046	0.046	1	.XXXXXXXXXXXXXX
0.046	0.046	1	.XXXXXXXXXXXXXX
0.046	0.046	0	
0.046	0.047	0	
0.047	0.047	1	.XXXXXXXXXXXXXX

TABLE XXXIV

DELTA CAPACITIES

SCS-301C473K **4000 HOURS**

```
OF DATA POINTS      50   MINIMUM       0.0002  #    1  MAXIMUM   0.0015  #   22   MEDIAN    0.0005
MEAN VALUE    0.0035     STANDARD DEVIATION     0.0002
FROM     TO    COUNT
 0.000   0.000    4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.000   0.000    0
 0.000   0.000    6   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.000   0.000    0
 0.000   0.000   12   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.000   0.000    0
 0.000   0.001   11   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.001   0.001    0
 0.001   0.001    5   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.001   0.001    0
 0.001   0.001    7   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.001   0.001    0
 0.001   0.001    3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.001   0.001    0
 0.001   0.001    1   .XXXXXXXXXX
 0.001   0.001    0
 0.001   0.001    0
 0.001   0.001    0
 0.001   0.001    0
 0.001   0.001    0
 0.001   0.001    0
 0.001   0.001    0
 0.001   0.001    0
 0.001   0.001    0
 0.001   0.001    0
 0.001   0.001    0
 0.001   0.002    1   .XXXXXXXXXX
```

TABLE XXXIV

INITIAL CAPACITIES

SCS-301C334K **4000 HOURS**

DATA POINTS 50 MINIMUM 0.3085 # 39 MAXIMUM 0.3469 # 3 MEDIAN 0.3296
MEAN VALUE 0.3290 STANDARD DEVIATION 0.0103

FROM	TO	COUNT
0.308	0.309	2
0.309	0.310	2
0.310	0.311	0
0.311	0.312	0
0.312	0.313	1
0.313	0.314	2
0.314	0.315	0
0.315	0.316	0
0.316	0.317	0
0.317	0.318	1
0.318	0.319	0
0.319	0.320	3
0.320	0.321	0
0.321	0.322	0
0.322	0.323	1
0.323	0.324	4
0.324	0.325	0
0.325	0.326	0
0.326	0.327	1
0.327	0.328	2
0.328	0.329	3
0.329	0.330	6
0.330	0.331	0
0.331	0.332	0
0.332	0.333	4
0.333	0.334	3
0.334	0.335	0
0.335	0.336	0
0.336	0.337	4
0.337	0.338	1
0.338	0.339	1
0.339	0.340	3
0.340	0.341	0
0.341	0.342	0
0.342	0.343	1
0.343	0.344	3
0.344	0.345	0
0.345	0.346	0
0.346	0.347	2

TABLE XXXIV

FINAL CAPACITIES

SCS-301C334K **4000 HOURS**

```
OF DATA POINTS     53  MINIMUM         0.3004 #    39  MAXIMUM    0.3429 #    3   MEDIAN   0.3251
MEAN VALUE    0.3247   STANDARD DEVIATION      0.0103
FROM    TO      COUNT
 0.300   0.302   1   .XXXXXXXXXXXX
 0.302   0.304   1   .XXXXXXXXXXXX
 0.304   0.306   0
 0.306   0.308   3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.308   0.310   3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.310   0.312   0
 0.312   0.314   2   .XXXXXXXXXXXXXXXXXXXXXXXX
 0.314   0.316   0
 0.316   0.318   2   .XXXXXXXXXXXXXXXXXXXXXXXX
 0.318   0.320   5   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.320   0.322   0
 0.322   0.324   8   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.324   0.326   0
 0.326   0.328   7   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.328   0.330   7   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.330   0.332   0
 0.332   0.334   4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.334   0.336   0
 0.336   0.338   3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 0.338   0.340   1   .XXXXXXXXXXXX
 0.340   0.342   0
 0.342   0.344   3   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

TABLE XXXIV

DELTA CAPACITIES

SCS-301C334K 4000 HOURS

NO OF DATA POINTS 50 MINIMUM 0.0011 # 7 MAXIMUM 0.0269 # 11 MEDIAN 0.0044
MEAN VALUE 0.0049 STANDARD DEVIATION 0.0036

FROM	TO	COUNT	
0.001	0.002	3	.XXXXXXXXXXXXXXXXXXXXXXXX
0.002	0.003	6	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.003	0.004	11	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.004	0.005	11	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.005	0.006	12	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.006	0.007	3	.XXXXXXXXXXXXXXXXXXXXXXXX
0.007	0.008	1	.XXXXXXXX
0.008	0.009	2	.XXXXXXXXXXXXXXXX
0.009	0.010	0	
0.010	0.011	0	
0.011	0.012	0	
0.012	0.013	0	
0.013	0.014	0	
0.014	0.015	0	
0.015	0.016	0	
0.016	0.017	0	
0.017	0.018	0	
0.018	0.019	0	
0.019	0.020	0	
0.020	0.021	0	
0.021	0.022	0	
0.022	0.023	0	
0.023	0.024	0	
0.024	0.025	0	
0.025	0.026	0	
0.026	0.027	1	.XXXXXXXX

TABLE XXXIV

INITIAL CAPACITIES

SCS-301C105K 4000 HOURS

NO OF DATA POINTS 50 MINIMUM 0.9276 # 46 MAXIMUM 1.0393 # 3 MEDIAN 0.9699
MEAN VALUE 0.9726 STANDARD DEVIATION 0.0274

FROM	TO	COUNT	
0.925	0.930	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.930	0.935	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.935	0.940	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.940	0.945	1	.XXXXXXXXXXXXXXXXXXXX
0.945	0.950	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.950	0.955	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.955	0.960	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.960	0.965	0	
0.965	0.970	4	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.970	0.975	0	
0.975	0.980	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.980	0.985	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.985	0.990	5	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.990	0.995	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.995	1.000	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.000	1.005	3	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.005	1.010	2	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.010	1.015	0	
1.015	1.020	1	.XXXXXXXXXXXXXXXXXXXX
1.020	1.025	1	.XXXXXXXXXXXXXXXXXXXX
1.025	1.030	0	
1.030	1.035	0	
1.035	1.040	1	.XXXXXXXXXXXXXXXXXXXX

TABLE XXXIV

FINAL CAPACITIES

SCS-301C105K 4000 HOURS

NO OF DATA POINTS 50 MINIMUM 0.9199 # 46 MAXIMUM 1.0284 # 3 MEDIAN 0.9609

MEAN VALUE 0.9649 STANDARD DEVIATION 0.0282

FROM	TO	COUNT
0.915	0.920	3
0.920	0.925	0
0.925	0.930	4
0.930	0.935	1
0.935	0.940	3
0.940	0.945	4
0.945	0.950	4
0.950	0.955	4
0.955	0.960	2
0.960	0.965	1
0.965	0.970	2
0.970	0.975	1
0.975	0.980	5
0.980	0.985	4
0.985	0.990	3
0.990	0.995	1
0.995	1.000	3
1.000	1.005	0
1.005	1.010	2
1.010	1.015	2
1.015	1.020	0
1.020	1.025	0
1.025	1.030	1

TABLE XXXIV

DELTA CAPACITIES

SCS-301C105K 4000 HOURS

NO OF DATA POINTS 50 MINIMUM 0.0000 # 5 MAXIMUM 0.0840 # 12 MEDIAN 0.0060

MEAN VALUE 0.0104 STANDARD DEVIATION 0.0149

FROM	TO	COUNT	
0.000	0.005	17	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.005	0.010	24	.XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.010	0.015	3	.XXXXXXXXXXXX
0.015	0.020	1	.XXXX
0.020	0.025	0	
0.025	0.030	1	.XXXX
0.030	0.035	0	
0.035	0.040	1	.XXXX
0.040	0.045	1	.XXXX
0.045	0.050	0	
0.050	0.055	0	
0.055	0.060	1	.XXXX
0.060	0.065	0	
0.065	0.070	0	
0.070	0.075	0	
0.075	0.080	0	
0.080	0.085	1	.XXXX

contained. Random samples were chosen for each measurement interval and the Delta C for each group was determined by comparison with the initially read capacity for each part and calculated by the computer as programmed. All parts were found to be satisfactory thru the 4000 hour readout.

3.11.10.1 Capacities at the 6000 and 8000 Hour Readouts

Tables XXXV, XXXVI and XXXVII covering the initial capacities, 6000 hour readout capacities, and delta capacities computed respectively indicated that all parts continued to be satisfactory. The 8000 hour readout disclosed failures which had occurred between 6000 and 8000 hours.

3.11.11 Analysis of Capacitors at the 8000 Period

At the 8000 hour readout, measurement of the 50 random samples of each part, 100 samples per oven, disclosed failures as listed:

Oven #*	High Dissipation Factor	Low Insulation Res.	Open
1	9	15	
2	7	6	3
3	27	1	

*See 3.11.7 for a listing of capacitor values in each oven.

An analysis of the failed capacitors and a preliminary investigation of oven operation led to the conclusion that the temperatures

TABLE XXXV

INITIAL CAPACITIES

SCS-301B104K 6000 HOURS

NO OF DATA POINTS 50 MINIMUM 0.0910 # 27 MAXIMUM 0.1070 # 39 MEDIAN 0.0969
MEAN VALUE 0.0971 STANDARD DEVIATION 0.0037

FROM	TO	COUNT
0.090	0.091	2
0.091	0.092	1
0.092	0.093	6
0.093	0.094	5
0.094	0.095	1
0.095	0.096	6
0.096	0.097	8
0.097	0.098	6
0.098	0.099	2
0.099	0.100	1
0.100	0.101	3
0.101	0.102	3
0.102	0.103	3
0.103	0.104	1
0.104	0.105	1
0.105	0.106	0
0.106	0.107	0
0.107	0.108	1

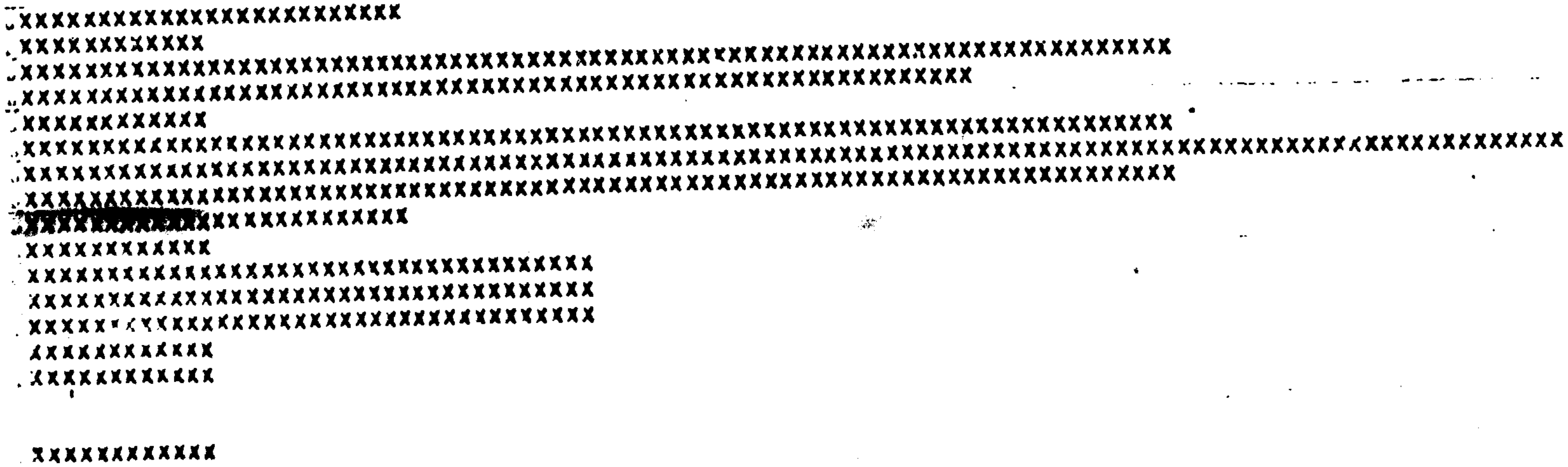


TABLE XXXV

INITIAL CAPACITIES

SCS-301B105K 6000 HOURS

```
NO OF DATA POINTS     50  MINIMUM     0.9173  #   13  MAXIMUM     1.0767  #    4    MEDIAN     0.9787
 MEAN VALUE     0.9876    STANDARD DEVIATION     0.0379
  FROM   TO    COUNT
  0.910   0.920    1   .XXXXXXXXXXXX
  0.920   0.930    0
  0.930   0.940    1   .XXXXXXXXXXXX
  0.940   0.950    6   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  0.950   0.960    5   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  0.960   0.970    8   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  0.970   0.980    5   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  0.980   0.990    4   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  0.990   1.000    8   .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  1.000   1.010    1   .XXXXXXXXXXXX
  1.010   1.020    0
  1.020   1.030    2    XXXXXXXXXXXXXXXXXXXXXXXX
  1.030   1.040    4    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  1.040   1.050    1   .XXXXXXXXXXXX
  1.050   1.060    1   .XXXXXXXXXXXX
  1.060   1.070    2   .XXXXXXXXXXXXXXXXXXXXXXXX
  1.070   1.080    1   .XXXXXXXXXXXX
```

TABLE XXXV

INITIAL CAPACITIES

SCS-301B405K 6000 HOURS

NO. OF DATA POINTS 50 MINIMUM 3.6990 # 20 MAXIMUM 4.0930 # 37 MEDIAN 3.8935
MEAN VALUE 3.8905 STANDARD DEVIATION 0.0940

FROM	TO	COUNT	
3.690	3.700	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.700	3.710	0	
3.710	3.720	0	
3.720	3.730	0	
3.730	3.740	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.740	3.750	0	
3.750	3.760	0	
3.760	3.770	1	XXXXXXXXXXXXXXXXXXXX
3.770	3.780	1	XXXXXXXXXXXXXXXXXXXX
3.780	3.790	0	
3.790	3.800	5	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.800	3.810	0	
3.810	3.820	1	XXXXXXXXXXXXXXXXXXXX
3.820	3.830	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.830	3.840	4	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.840	3.850	0	
3.850	3.860	0	
3.860	3.870	1	XXXXXXXXXXXXXXXXXXXX
3.870	3.880	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.880	3.890	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.890	3.900	5	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.900	3.910	1	XXXXXXXXXXXXXXXXXXXX
3.910	3.920	0	
3.920	3.930	1	XXXXXXXXXXXXXXXXXXXX
3.930	3.940	4	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.940	3.950	1	XXXXXXXXXXXXXXXXXXXX
3.950	3.960	0	
3.960	3.970	4	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.970	3.980	1	XXXXXXXXXXXXXXXXXXXX
3.980	3.990	3	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.990	4.000	3	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.000	4.010	1	XXXXXXXXXXXXXXXXXXXX
4.010	4.020	0	
4.020	4.030	0	
4.030	4.040	1	XXXXXXXXXXXXXXXXXXXX
4.040	4.050	0	
4.050	4.060	0	
4.060	4.070	0	
4.070	4.080	0	
4.080	4.090	1	XXXXXXXXXXXXXXXXXXXX
4.090	4.100	1	XXXXXXXXXXXXXXXXXXXX

TABLE XXXV

INITIAL CAPACITIES

SCS-301C473K 6000 HOURS

NO OF DATA POINTS 50 MINIMUM 0.0433 # 42 MAXIMUM 0.0470 # 26 MEDIAN 0.0453
MEAN VALUE 0.0453 STANDARD DEVIATION 0.0010

FROM	TO	COUNT	
0.043	0.043	1	XXXXXXXXXXXXXXX
0.043	0.043	0	
0.043	0.044	0	
0.044	0.044	0	
0.044	0.044	0	
0.044	0.044	3	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.044	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.044	1	XXXXXXXXXXXXXXX
0.044	0.044	0	
0.044	0.044	0	
0.044	0.044	3	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.044	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.045	0	
0.045	0.045	1	XXXXXXXXXXXXXXX
0.045	0.045	1	XXXXXXXXXXXXXXX
0.045	0.045	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.045	3	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.045	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.045	0	
0.045	0.045	0	
0.045	0.045	4	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.045	3	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.046	0	
0.046	0.046	0	
0.046	0.046	0	
0.046	0.046	1	XXXXXXXXXXXXXXX
0.046	0.046	5	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.046	0.046	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.046	0.046	1	XXXXXXXXXXXXXXX
0.046	0.046	1	XXXXXXXXXXXXXXX
0.046	0.046	6	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.046	0.046	3	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.046	0.047	0	
0.047	0.047	1	XXXXXXXXXXXXXXX
0.047	0.047	0	
0.047	0.047	0	
0.047	0.047	0	
0.047	0.047	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

TABLE XXXV

INITIAL CAPACITIES

SCS-301C334K 6000 HOURS

NO OF DATA POINTS 50 MINIMUM 0.3024 # 46 MAXIMUM 0.3539 # 7 MEDIAN 0.3310
MEAN VALUE 0.3286 STANDARD DEVIATION 0.0127

FROM	TO	COUNT	
0.302	0.304	3	XXXXXXXXXXXXXXXXXXXXXX
0.304	0.306	0	
0.306	0.308	1	XXXXXXX
0.308	0.310	2	XXXXXXXXXXXXXXX
0.310	0.312	0	
0.312	0.314	2	XXXXXXXXXXXXXXX
0.314	0.316	0	
0.316	0.318	0	
0.318	0.320	3	XXXXXXXXXXXXXXXXXXXXXX
0.320	0.322	0	
0.322	0.324	10	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.324	0.326	0	
0.326	0.328	2	XXXXXXXXXXXXXXX
0.328	0.330	2	XXXXXXXXXXXXXXX
0.330	0.332	0	
0.332	0.334	12	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.334	0.336	0	
0.336	0.338	1	XXXXXXX
0.338	0.340	2	XXXXXXXXXXXXXXX
0.340	0.342	0	
0.342	0.344	5	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.344	0.346	0	
0.346	0.348	3	XXXXXXXXXXXXXXXXXXXXXX
0.348	0.350	1	XXXXXXX
0.350	0.352	0	
0.352	0.354	1	XXXXXXX

TABLE XXXV

INITIAL CAPACITIES

SCS-301C105K 6000 HOURS

```
NO OF DATA POINTS        50  MINIMUM        0.9331  #    24  MAXIMUM       1.0683  #   45     MEDIAN       0.9875
   MEAN VALUE       0.9869    STANDARD DEVIATION        0.0302
    FROM    TO    COUNT
    0.930    0.935    1    .XXXXXXXXXXXXXXXXXXX
    0.935    0.940    1    .XXXXXXXXXXXXXXXXXXX
    0.940    0.945    2    .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.945    0.950    3    .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.950    0.955    1    .XXXXXXXXXXXXXXXXXXX
    0.955    0.960    2    .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.960    0.965    2    .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.965    0.970    5    .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.970    0.975    2    .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.975    0.980    4    .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.980    0.985    0
    0.985    0.990    5    .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.990    0.995    4    .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.995    1.000    5    .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    1.000    1.005    1    .XXXXXXXXXXXXXXXXXXX
    1.005    1.010    0
    1.010    1.015    3    .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    1.015    1.020    3    .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    1.020    1.025    2    .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    1.025    1.030    0
    1.030    1.035    1    .XXXXXXXXXXXXXXXXXXX
    1.035    1.040    0
    1.040    1.045    0
    1.045    1.050    2    .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    1.050    1.055    0
    1.055    1.060    0
    1.060    1.065    0
    1.065    1.070    1    .XXXXXXXXXXXXXXXXXXX
```

TABLE XXXVI

FINAL CAPACITIES

SCS-301B104K 6000 HOURS

NO OF DATA POINTS 50 MINIMUM 0.0899 # 45 MAXIMUM 0.1049 # 39 MEDIAN 0.0953
MEAN VALUE 0.0959 STANDARD DEVIATION 0.0035

FROM	TO	COUNT	
0.090	0.090	1	XXXXXXXXXXXXXXXXXXXX
0.090	0.091	0	
0.091	0.091	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.091	0.092	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.092	0.092	3	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.092	0.092	4	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.092	0.093	1	XXXXXXXXXXXXXXXXXXXX
0.093	0.093	1	XXXXXXXXXXXXXXXXXXXX
0.093	0.094	1	XXXXXXXXXXXXXXXXXXXX
0.094	0.094	4	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.094	0.095	3	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.095	0.095	5	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.095	0.096	3	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.096	0.096	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.096	0.097	1	XXXXXXXXXXXXXXXXXXXX
0.097	0.097	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.097	0.098	1	XXXXXXXXXXXXXXXXXXXX
0.098	0.098	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.098	0.099	1	XXXXXXXXXXXXXXXXXXXX
0.099	0.099	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.099	0.100	1	XXXXXXXXXXXXXXXXXXXX
0.100	0.100	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.100	0.101	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.101	0.101	1	XXXXXXXXXXXXXXXXXXXX
0.101	0.102	1	XXXXXXXXXXXXXXXXXXXX
0.102	0.102	0	
0.102	0.103	1	XXXXXXXXXXXXXXXXXXXX
0.103	0.103	0	
0.103	0.104	0	
0.104	0.104	0	
0.104	0.105	1	XXXXXXXXXXXXXXXXXXXX

TABLE XXXVI

FINAL CAPACITIES

SCS-301B105K 6000 HOURS

```
NO OF DATA POINTS      50   MINIMUM      0.9032  #    13  MAXIMUM      1.0774  #    4    MEDIAN      0.9734
  MEAN VALUE      0.9812    STANDARD DEVIATION      0.0389
   FROM    TO      COUNT
    0.900      0.910    1    XXXXXXXXXX
    0.910      0.920    0
    0.920      0.930    0
    0.930      0.940    4    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.940      0.950    6    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.950      0.960    6    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.960      0.970    8    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.970      0.980    2    XXXXXXXXXXXXXXXXXXXX
    0.980      0.990   10    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.990      1.000    2    XXXXXXXXXXXXXXXXXXXX
    1.000      1.010    0
    1.010      1.020    2    XXXXXXXXXXXXXXXXXXXX
    1.020      1.030    2    XXXXXXXXXXXXXXXXXXXX
    1.030      1.040    2    XXXXXXXXXXXXXXXXXXXX
    1.040      1.050    1    XXXXXXXXXX
    1.050      1.060    1    XXXXXXXXXX
    1.060      1.070    2    XXXXXXXXXXXXXXXXXXXX
    1.070      1.080    1    XXXXXXXXXX
```

TABLE XXXVI

FINAL CAPACITIES

SCS-301B405K 6000 HOURS

```
NO OF DATA POINTS      50  MINIMUM       3.6240  #   10  MAXIMUM      4.0600  #   37    MEDIAN      3.8590
  MEAN VALUE      3.8450   STANDARD DEVIATION      0.0996
   FROM     TO     COUNT
    3.620    3.640    2   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    3.640    3.660    0
    3.660    3.680    1   XXXXXXXXXXXXXXX
    3.680    3.700    1   XXXXXXXXXXXXXXX
    3.700    3.720    1   XXXXXXXXXXXXXXX
    3.720    3.740    3   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    3.740    3.760    3   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    3.760    3.780    1   XXXXXXXXXXXXXXX
    3.780    3.800    5   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    3.800    3.820    5   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    3.820    3.840    1   XXXXXXXXXXXXXXX
    3.840    3.860    2   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    3.860    3.880    3   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    3.880    3.900    6   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    3.900    3.920    4   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    3.920    3.940    2   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    3.940    3.960    4   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    3.960    3.980    3   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    3.980    4.000    0
    4.000    4.020    1   XXXXXXXXXXXXXXX
    4.020    4.040    1   XXXXXXXXXXXXXXX
    4.040    4.060    0
    4.060    4.080    1   XXXXXXXXXXXXXXX
```

TABLE XXXVI

FINAL CAPACITIES

SCS-301C473K 6000 HOURS

```
NO OF DATA POINTS      50  MINIMUM     0.0001  #   39  MAXIMUM     0.0029  #   13   MEDIAN     0.0009
   MEAN VALUE      0.0009  STANDARD DEVIATION      0.0004
    FROM    TO     COUNT
    0.000   0.000    1   XXXXXX
    0.000   0.000    0
    0.000   0.000    2   XXXXXXXXXXXXX
    0.000   0.000    2   XXXXXXXXXXXXX
    0.000   0.001    4   XXXXXXXXXXXXXXXXXXXXXXXXXX
    0.001   0.001    5   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.001   0.001    4   XXXXXXXXXXXXXXXXXXXXXXXXXX
    0.001   0.001    3   XXXXXXXXXXXXXXXXXXXX
    0.001   0.001    9   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.001   0.001   15   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.001   0.001    1   XXXXXX
    0.001   0.001    1   XXXXXX
    0.001   0.001    1   XXXXXX
    0.001   0.001    1   XXXXXX
    0.001   0.002    0
    0.002   0.002    0
    0.002   0.002    0
    0.002   0.002    0
    0.002   0.002    0
    0.002   0.002    0
    0.002   0.002    0
    0.002   0.002    0
    0.002   0.002    0
    0.002   0.002    0
    0.002   0.003    0
    0.003   0.003    0
    0.003   0.003    0
    0.003   0.003    0
    0.003   0.003    1   XXXXXX
```

-288-

TABLE XXXVI

FINAL CAPACITIES

SCS-301C334K 6000 HOURS

NO OF DATA POINTS 50 MINIMUM 0.2993 # 46 MAXIMUM 0.3497 # 7 MEDIAN 0.3277
MEAN VALUE 0.3250 STANDARD DEVIATION 0.0126

FROM	TO	COUNT	
0.298	0.300	3	XXXXXXXXXXXXXXXXXXXXXXXX
0.300	0.302	0	
0.302	0.304	3	XXXXXXXXXXXXXXXXXXXXXXXX
0.304	0.306	0	
0.306	0.308	0	
0.308	0.310	1	XXXXXXXX
0.310	0.312	0	
0.312	0.314	2	XXXXXXXXXXXXXXXX
0.314	0.316	0	
0.316	0.318	1	XXXXXXXX
0.318	0.320	12	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.320	0.322	0	
0.322	0.324	1	XXXXXXXX
0.324	0.326	0	
0.326	0.328	2	XXXXXXXXXXXXXXXX
0.329	0.330	10	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.330	0.332	0	
0.332	0.334	5	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.334	0.336	0	
0.336	0.338	0	
0.338	0.340	4	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.340	0.342	0	
0.342	0.344	5	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.344	0.346	0	
0.346	0.348	0	
0.348	0.350	1	XXXXXXXX

TABLE XXXVI

FINAL CAPACITIES

SCS-301C105K 6000 HOURS

NO OF DATA POINTS 50 MINIMUM 0.9004 # 43 MAXIMUM 1.0382 # 49 MEDIAN 0.9700
MEAN VALUE 0.9723 STANDARD DEVIATION 0.0313

FROM	TO	COUNT	
0.900	0.905	1	XXXXXXXXXXXXXX
0.905	0.910	0	
0.910	0.915	0	
0.915	0.920	1	XXXXXXXXXXXXXX
0.920	0.925	1	XXXXXXXXXXXXXX
0.925	0.930	0	
0.930	0.935	3	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.935	0.940	4	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.940	0.945	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.945	0.950	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.950	0.955	1	XXXXXXXXXXXXXX
0.955	0.960	3	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.960	0.965	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.965	0.970	6	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.970	0.975	1	XXXXXXXXXXXXXX
0.975	0.980	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.980	0.985	0	
0.985	0.990	7	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.990	0.995	0	
0.995	1.000	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.000	1.005	5	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.005	1.010	0	
1.010	1.015	3	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.015	1.020	1	XXXXXXXXXXXXXX
1.020	1.025	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
1.025	1.030	0	
1.030	1.035	0	
1.035	1.040	1	XXXXXXXXXXXXXX

TABLE XXXVII

DELTA CAPACITIES

SCS-301B104K 6000 HOURS

```
NO OF DATA POINTS      50  MINIMUM     0.0000  #   27  MAXIMUM     0.0035  #   1   MEDIAN     0.0011
  MEAN VALUE      0.0012   STANDARD DEVIATION     0.0007
   FROM    TO     COUNT
    0.000   0.000    2  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.000   0.000    2  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.000   0.000    1  .XXXXXXXXXXXXXXX
    0.000   0.000    0  .
    0.000   0.001    3  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.001   0.001    3  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.001   0.001    2  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.001   0.001    1  .XXXXXXXXXXXXXXX
    0.001   0.001    2  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.001   0.001    6  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.001   0.001    6  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.001   0.001    2  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.001   0.001    2  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.001   0.001    4  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.001   0.002    3  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.002   0.002    2  .XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.002   0.002    0
    0.002   0.002    0
    0.002   0.002    1  .XXXXXXXXXXXXXXX
    0.002   0.002    1  .XXXXXXXXXXXXXXX
    0.002   0.002    1   XXXXXXXXXXXXXXX
    0.002   0.002    0
    0.002   0.002    1   XXXXXXXXXXXXXXX
    0.002   0.002    1   XXXXXXXXXXXXXXX
    0.002   0.003    0
    0.003   0.003    1   XXXXXXXXXXXXXXX
    0.003   0.003    1  .XXXXXXXXXXXXXXX
    0.003   0.003    1  .XXXXXXXXXXXXXXX
    0.003   0.003    0
    0.003   0.003    0
    0.003   0.003    0
    0.003   0.003    0
    0.003   0.003    0
    0.003   0.003    0
    0.003   0.004    1   XXXXXXXXXXXXXXX
```

TABLE XXXVII

DELTA CAPACITIES

SCS-301B105K 6000 HOURS

NO OF DATA POINTS 50 MINIMUM 0.0001 # 15 MAXIMUM 0.0149 # 23 MEDIAN 0.0060
MEAN VALUE 0.0065 STANDARD DEVIATION 0.0042

FROM	TO	COUNT	
0.000	0.001	1	XXXXXXXXXXXXXXXX
0.001	0.001	5	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.001	0.002	1	XXXXXXXXXXXXXXXX
0.002	0.002	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.002	0.003	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.003	0.003	3	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.003	0.004	0	
0.004	0.004	1	XXXXXXXXXXXXXXXX
0.004	0.005	4	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.005	0.005	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.005	0.006	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.006	0.006	3	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.006	0.007	1	XXXXXXXXXXXXXXXX
0.007	0.007	6	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.007	0.008	0	
0.008	0.008	1	XXXXXXXXXXXXXXXX
0.008	0.009	1	XXXXXXXXXXXXXXXX
0.009	0.009	0	
0.009	0.010	1	XXXXXXXXXXXXXXXX
0.010	0.010	1	XXXXXXXXXXXXXXXX
0.010	0.011	3	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.011	0.011	1	XXXXXXXXXXXXXXXX
0.011	0.012	1	XXXXXXXXXXXXXXXX
0.012	0.012	1	XXXXXXXXXXXXXXXX
0.012	0.013	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.013	0.013	1	XXXXXXXXXXXXXXXX
0.013	0.014	0	
0.014	0.014	1	XXXXXXXXXXXXXXXX
0.014	0.015	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.015	0.015	1	XXXXXXXXXXXXXXXX

TABLE XXXVII

DELTA CAPACITIES

SCS-301B405K 6000 HOURS

NO OF DATA POINTS 50 MINIMUM 0.0210 # 15 MAXIMUM 0.0940 # 43 MEDIAN 0.0415
MEAN VALUE 0.0477 STANDARD DEVIATION 0.0195

FROM	TO	COUNT	
0.020	0.023	4	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.023	0.025	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.025	0.028	0	
0.028	0.030	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.030	0.033	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.033	0.035	6	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.035	0.038	1	XXXXXXXXXXXXXXX
0.038	0.040	4	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.040	0.043	6	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.043	0.045	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.048	1	XXXXXXXXXXXXXXX
0.048	0.050	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.050	0.053	1	XXXXXXXXXXXXXXX
0.053	0.055	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.055	0.058	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.058	0.060	1	XXXXXXXXXXXXXXX
0.060	0.063	0	
0.063	0.065	1	XXXXXXXXXXXXXXX
0.065	0.068	0	
0.068	0.070	1	XXXXXXXXXXXXXXX
0.070	0.073	3	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.073	0.075	1	XXXXXXXXXXXXXXX
0.075	0.078	1	XXXXXXXXXXXXXXX
0.078	0.080	1	XXXXXXXXXXXXXXX
0.080	0.083	1	XXXXXXXXXXXXXXX
0.083	0.085	1	XXXXXXXXXXXXXXX
0.085	0.088	0	
0.088	0.090	0	
0.090	0.093	1	XXXXXXXXXXXXXXX
0.093	0.095	1	XXXXXXXXXXXXXXX

TABLE XXVII

DELTA CAPACITIES

SCS-301C473K 6000 HOURS

NO OF DATA POINTS 50 MINIMUM 0.0429 # 42 MAXIMUM 0.0460 # 26 MEDIAN 0.0444
MEAN VALUE 0.0445 STANDARD DEVIATION 0.0009

FROM	TO	COUNT	
0.043	0.043	1	XXXXXXXXXXXXXXXXXXX
0.043	0.043	4	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.043	0.043	0	
0.043	0.043	1	XXXXXXXXXXXXXXXXXXX
0.043	0.043	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.043	0.043	0	
0.043	0.044	0	
0.044	0.044	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.044	3	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.044	1	XXXXXXXXXXXXXXXXXXX
0.044	0.044	4	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.044	3	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.044	0	
0.044	0.044	0	
0.044	0.044	0	
0.044	0.044	5	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.044	0.045	0	
0.045	0.045	1	XXXXXXXXXXXXXXXXXXX
0.045	0.045	0	
0.045	0.045	3	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.045	3	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.045	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.045	0	
0.045	0.045	0	
0.045	0.045	5	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.045	3	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.045	0.046	0	
0.046	0.046	0	
0.046	0.046	1	XXXXXXXXXXXXXXXXXXX
0.046	0.046	2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
0.046	0.046	1	XXXXXXXXXXXXXXXXXXX
0.046	0.046	3	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

TABLE XXXVII

DELTA CAPACITIES

SCS-301C334K 6000 HOURS

```
NO OF DATA POINTS      50  MINIMUM       0.0006  #   38  MAXIMUM     0.0062  #   34    MEDIAN      0.0040
  MEAN VALUE      0.0037    STANDARD DEVIATION       0.0012
   FROM    TO    COUNT
    0.000    0.001   2   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.001    0.001   1   XXXXXXXXXXXXXXX
    0.001    0.001   0
    0.001    0.001   1   XXXXXXXXXXXXXXX
    0.001    0.001   1   XXXXXXXXXXXXXXX
    0.001    0.002   1   XXXXXXXXXXXXXXX
    0.002    0.002   0
    0.002    0.002   0
    0.002    0.002   0
    0.002    0.002   0
    0.002    0.003   1   XXXXXXXXXXXXXXX
    0.003    0.003   2   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.003    0.003   1   XXXXXXXXXXXXXXX
    0.003    0.003   4   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.003    0.003   4   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.003    0.004   1   XXXXXXXXXXXXXXX
    0.004    0.004   3   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.004    0.004   6   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.004    0.004   6   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.004    0.004   6   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.004    0.005   3   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.005    0.005   3   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
    0.005    0.005   0
    0.005    0.005   1   XXXXXXXXXXXXXXX
    0.005    0.005   1   XXXXXXXXXXXXXXX
    0.005    0.006   1   XXXXXXXXXXXXXXX
    0.006    0.006   0
    0.006    0.006   0
    0.006    0.006   1   XXXXXXXXXXXXXXX
```

TABLE XXXVII

DELTA CAPACITIES

?'S-301C105K 6000 HOURS

```
NO OF DATA POINTS    50  MINIMUM     0.0001  #     5  MAXIMUM      0.0806  #    4    MEDIAN      0.0195
   MEAN VALUE      0.0243    STANDARD DEVIATION      0.0208
    FROM           COUNT
   0.000     0.005    8   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.005     0.010    8   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.010     0.015    5   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.015     0.020    5   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.020     0.025    5   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.025     0.030    3   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.030     0.035    4   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.035     0.040    2   XXXXXXXXXXXXXXXXXXXXXXXX
   0.040     0.045    3   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   0.045     0.050    1   XXXXXXXXXXXX
   0.050     0.055    0
   0.055     0.060    2   XXXXXXXXXXXXXXXXXXXXXXXX
   0.060     0.065    1   XXXXXXXXXXXX
   0.065     0.070    1   XXXXXXXXXXXX
   0.070     0.075    0
   0.075     0.080    1   XXXXXXXXXXXX
   0.080     0.085    1   XXXXXXXXXXXX
```

within ovens 1, 2 and 3 had become erratic and excessive. It was believed that intermittent sticking of the contacts of the temperature controls had occurred. It was apparent that the oven malfunction had occurred between the 6000 hour readout, where all parts were good, and the scheduled 8000 hour readout. Readouts were made on oven 3 at 8284 hours, oven 2 at 8562 hours, and oven 3 at 8942 hours.

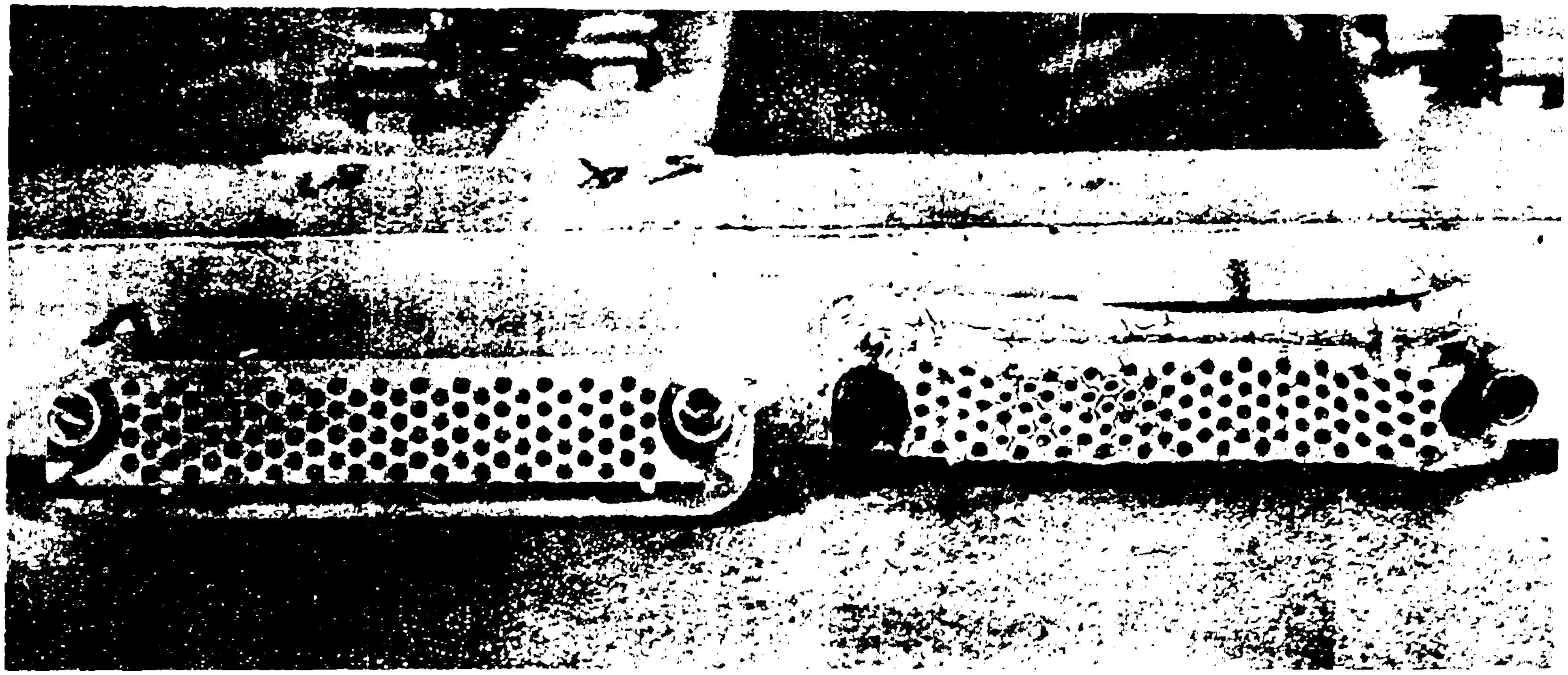
3.11.12 Oven Inspection

A thorough review and inspection of the oven contents disclosed that many capacitors exhibited external evidence of case plating reflow of solder and blackened and discolored leads and cases due to excessive temperature exposure.

An examination of the rack connectors showed them to be severly distorted due to excessive heat. See Figures 17 and 18. The effect of heat on new connectors of the same type as used in the ovens was evaluated with the following results:

Test Temperature	Result
125°C	no observable effect
135°C	very slight mechanical deformation
145°C	severe distortion.

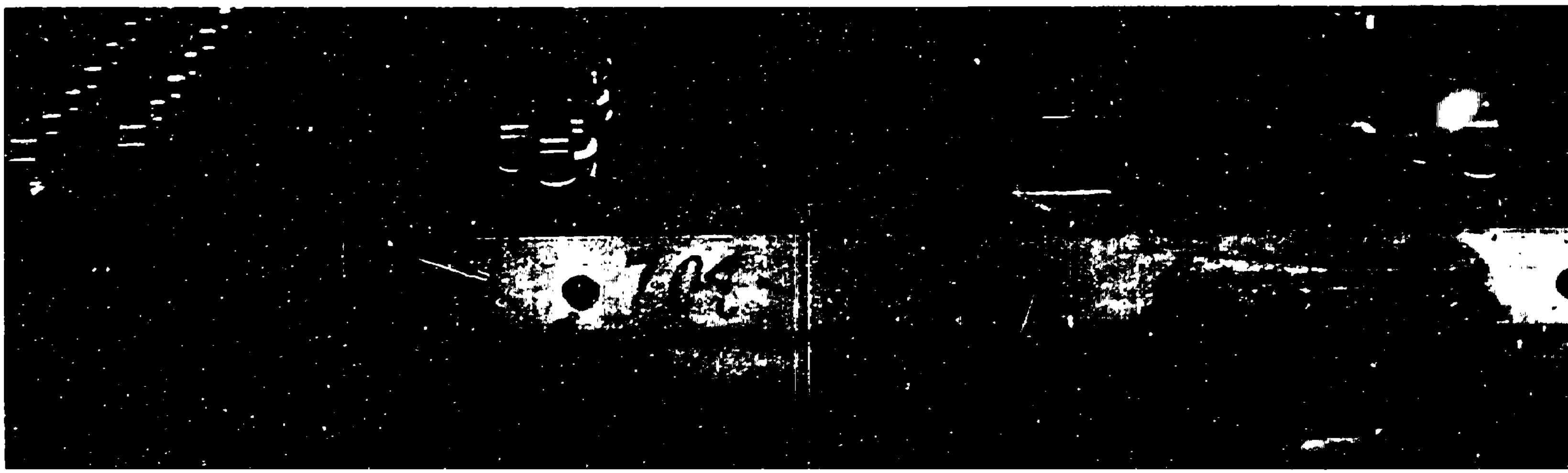
These results indicated that excessive heat had been generated within the ovens with temperatures well beyond the 125°C



Display of a new connector vs the high temperature damaged connector

Connector Comparison

Figure 17



High temperature damaged connectors as mounted on a typical capacitor test rack

Rack Connectors

Figure 18

setting thus seriously exceeding the temperature vs. life capability of metallized polysulfone film capacitors. The observed failures of high DF, low IR, and opens were consistent with over-temperature exposure of the capacitors.

3.11.13 Test Termination

Therefore, the test was considered as completed with the data taken at the 6000 hour readout for each oven. See Tables XXXV, XXXVI and XXXVII.

3.11.14 Failure Rate for Polysulfone Capacitors

Based on the test of 11,550 capacitors for 6000 hours (see 3.11.13) a failure rate of .0056% per 1K hours at a 90% confidence level was computed using the formula:

$$FR = \left(\frac{(F + 1)\ 10^5}{Hu}\right) \cdot \left(UC\right)$$

Where:

FR = % per 1K hours

F = Total number of failures

Hu = Total unit hours

UC = Max upper confidence limit factor.

The achieved failure rate evidences the capability of metallized polysulfone film dielectric hermetically sealed capacitors to demonstrate a low failure rate under maximum rated test conditions. This lot failed to achieve the anticipated .002% per 1K hours FR due

to the termination of test with the 6000 hour data readout. One failure was found at the 1000 hour readout (see 3.11.8).

SECTION 4

PROCESS AND CONTROLS

4.1 General

Presented in Figure 19 is the Process and Control Flow Chart applicable to the production and test of metallized polycarbonate and metallized polysulfone film capacitors. This covers the entire process from Receipt of Materials to Shipping of Finished Capacitors. A description of the process steps and controls follows.

4.1.1 Receiving of Materials and Incoming Inspection

No materials are considered as "accepted" until they have been inspected and have been determined to be satisfactory by the Quality Assurance Incoming Inspection Standards.

Quality and inspection criteria have been previously established for those materials common to the hermetically sealed film capacitor. Included are the electrotinned brass tubes, compression glass end seals insulating end caps, wire, solders, and potting resin.

Of prime concern is the intrinsic quality of the metallized film in the specific areas of film thickness and uniformity, metal thick-

PROCESS AND CONTROL FLOW CHART
METALLIZED POLYCARBONATE AND METALLIZED POLYSULFONE CAPACITORS

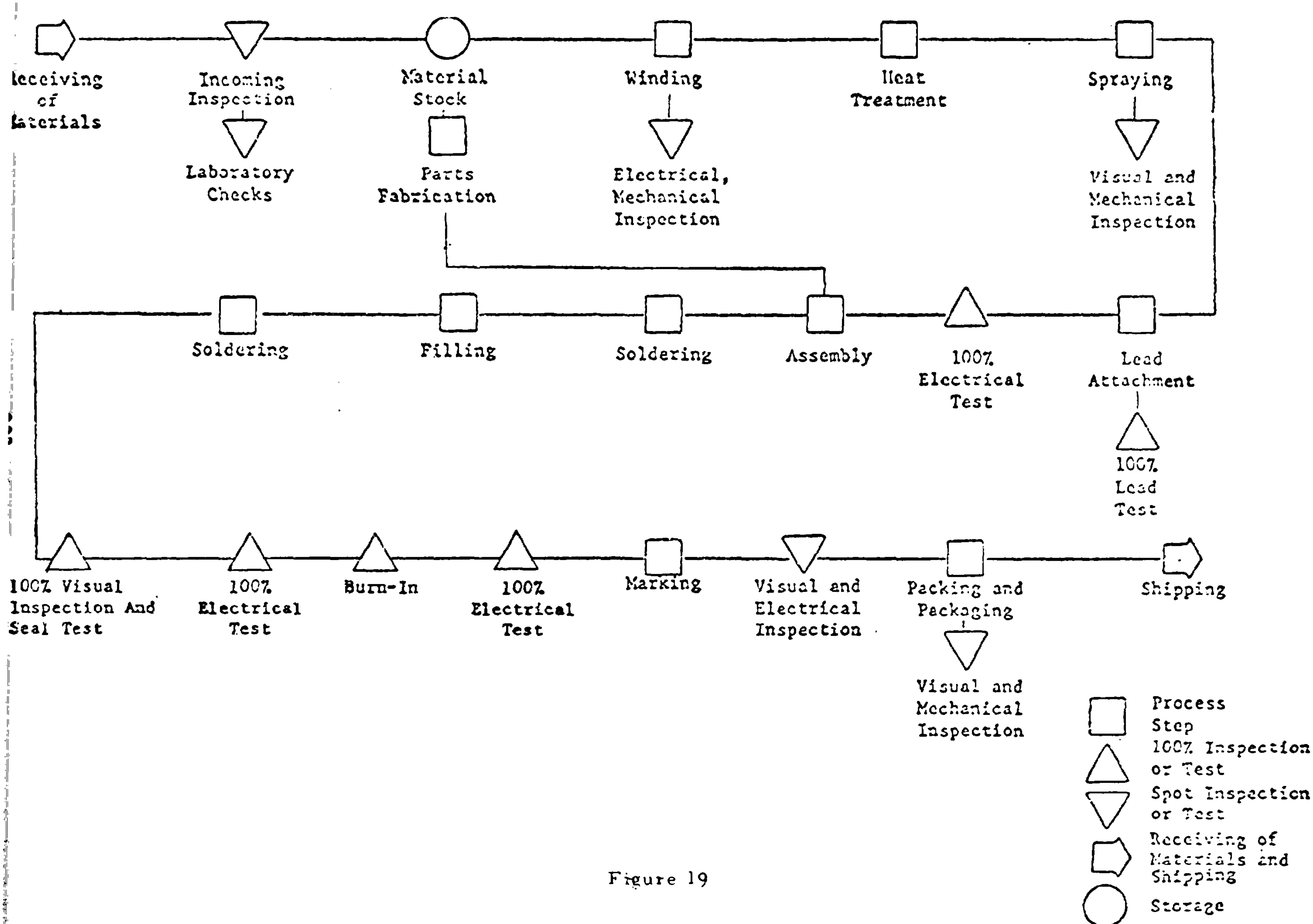


Figure 19

ness and uniformity, margin along one edge, condition of slit edges, width of film, holes, and foreign particles. Of equal concern is the condition of the roll, i.e. alignment of film, number of splices, wrinkles, and protective container or wrapper.

A thorough Incoming Inspection is mandatory if the ultimate goal of a very high quality capacitor is to be achieved.

4.1.2 Storage of Materials

With the exception of the metallized film, all materials are stored in their original containers in a clean, dry storage area. The metallized polycarbonate and metallized polysulfone film must be stored under environmentally controlled conditions in a storage area designed specifically for dielectric films and containing no other materials. Rolls are stored in protective containers, carefully stacked on shelves, in a dust-free, temperature, and humidity controlled area.

4.1.3 Section Winding and Inspection

The metallized film is received in an even number of rolls so that rolls may be paired with one roll containing the metal-free margin on the right and the second roll containing the metal-free margin on the left side. Capacitor sections are made by winding the two layers onto a small diameter mandrel to form a roll or cyliner. During the winding, proper alignment and tension are maintained to insure attainment of a capacitor section having good mechanical and electrical characteristics.

Patrol inspection is conducted by Quality Assurance to verify that the winding operation is being performed in accordance with the applicable specification and that all variables are under control. A sample toll-gate inspection is conducted on each lot of wound sections prior to release of the lot to the next operation.

4.1.4 Heat Treatment

Capacitor sections are placed in suitable containers into a circulating air oven and are exposed to the following conditions:

Metallized Polycarbonate - 20 Hours at 125°C in air.

Metallized Polysulfone - 12 Hours at 150°C in air.

4.1.5 End Spray

Capacitor sections are assembled into holding fixtures and sensitive areas such as mandrel holes and the sides of the sections are masked to prevent penetration by metal spray. The section ends are then sprayed with compatible metal by use of a metallizing gun to form surfaces for the attachment of wire leads. The masking material is removed and the capacitor sections are examined by Quality Assurance to confirm adequate metal end-spray with no penetration of metal into the mandrel hole.

4.1.6 Lead Attachment and Test

The lead wires, which are tinned copper clad steel, are attached to the end spray on the section ends by a suitable soldering or welding technique.

The wire leads are then 100% pull tested to assure bonded connections that are both mechanically and electrically adequate.

4.1.7 100% Electrical Test

All capacitor sections are tested for dielectric strength, capacitance, dissipation factor and insulation resistance. All electrical discrepancies are removed at this point.

4.1.8 Assembly, Seal and Eyelet Soldering, and Filling

The electrically good capacitor sections are capped on each end with an insulating end cap to prevent grounding to the outer metal tube. These sections are then assembled into electro-tinned brass tubes. The compression glass end seals are placed in position and are soldered to the metal tube. One end seal is solder sealed. A potting resin is introduced by vacuum filling with the unpolymerized liquid through the one remaining open eyelet. The open eyelet is then solder sealed to complete the hermetic seal.

4.1.9 100% Visual, Seal and Electrical Tests

The sealed capacitor is cleaned to remove any external residue after the assembly operations.

A 100% visual inspection is conducted under a 3-power magnification to assure that there are no visual discrepancies.

A 100% seal test is then performed consistent with the MIL specification and internal specification.

All capacitors are subjected to electrical measurements and tests consisting of dielectric strength, capacitance, dissipation factor, and insulation resistance. Rejects are removed.

A burn-in consisting of application of 140% of rated voltage for 250 hours at 125°C is performed on all capacitors.

The capacitors are then put through Final Electrical Testing to check parameters identical to the pre burn-in tests. Those parts that are satisfactory at this point are ready for the finishing operations.

4.1.10 Marking

The capacitors are stamped and serialized in accordance with the internal detail specification and with the applicable Military specifications.

4.1.11 Final Inspection

Quality Assurance inspection and testing insure that the finished capacitors satisfy all of the specified requirements.

4.1.12 Packing and Delivery

Capacitors are packaged in accordance with applicable Military requirements and/or customer Specification Control Drawings.

4.2 Problem Areas

Areas of concern in the manufacture of a high reliability metallized polycarbonate or metallized polysulfone film capacitor include materials and handling. In considering materials, of prime concern is the intrinsic quality of the metallized film in the specific areas of thickness of the film and uniformity of that thickness, thickness of the metallization and uniformity of that thickness, cleared margin along one edge, condition of film along slit edge with particular attention to rough or torn edges, hole defects, inclusion of foreign particles, and amount of residual solvents entrapped. Since the ultimate life of the finished capacitor is to a major extent dependent on the total of these factors, thorough inspection and evaluation is mandatory.

4.2.1 Film Measurement

A sufficient number of rolls of metallized film from each lot as received must be gauged to determine that the rolls and lot are of uniform thickness within acceptable limits. Film with thick and thin areas will produce non uniform sized rolls or sections which may fail dielectric strength tests due to breakdown in the thin areas.

4.2.2 Film Metallization - Thickness

A sufficient number of rolls of metallized film from each lot as received must be checked to determine the thickness of the metallization. The thickness is effectively measured by measuring the resistance of the metallization with the resultant resistance expressed

in ohms per square. Metallization that is too thick will result in capacitors which will not clear properly thus introducing severe degradation as shorts or low insulation resistance. Metallization that is too thin will result in power losses in the high resistance areas leading to hot spots and excessive temperature rise of the capacitor in current carrying applications.

4.2.3 Cleared Margin

The cleared margin along one edge of the roll of metallized film must be adequate to withstand the dielectric voltage stress and prevent flash over or low insulation resistance from the adjacent concentrically wound metallized film. Minimum margin is specified based on the rated and surge voltage rating of the capacitor.

4.2.4 Mechanical Condition

The mechanical condition of the metallized film along the metallized slit edge is of concern since rough and torn edges may result in poor quality lead attachment to the metallization at each end of the capacitor section during the manufacturing phase of end spray and lead attachment. Also such mechanical anomalies may result in damage to or provide conductive paths over the clear margin of the adjacent metallized film comprising the alternate electrode of the capacitor section.

4.2.5 Film Defects

Hole defects and inclusion of foreign particles both can result

in a conductive path to the adjacent film electrode metallization. Metallized film exhibits a self healing or clearing phenomenon which may occur through weak areas of the film, holes in the film, or conductive included particles. The defect area permits the flow of sufficient current to vaporize the aluminum metallization surrounding the defect area leaving a cleared insulating film margin which in turn causes the current flow to cease. This results in a capacitor which seldom suffers catastrophic failure unlike film-foil capacitors where catastrophic shorts may be the prime failure mode.

4.2.6 Entrapped Solvents

Entrapped solvents, residuals from the basic film manufacturing process, if allowed to remain within the film would result in electrical parameter degradation in a relatively short time. In so far as possible these residuals must be removed from the film in order to maintain a high insulation resistance for the lifetime of the capacitor.

4.2.7 Enclosure

In the case of any high reliability product, protection from the hostile environment in particular moisture and contaminants must be provided. In the case of high reliability capacitor sections, that protection is afforded by inserting the section into a metal enclosure or case solder sealed with an insulating glass-to-metal seal at one or both ends with the section attached leads emerging at both ends of the metal case. To afford protection from the environment of shock and

vibration provision must be made during the assembly process to provide a shock and vibration cushion around the section positioned within the case.

4.2.8 Contamination Effects

Contamination during the manufacturing process must be avoided at all times since it does little good to seal off the section from the hostile environment if contamination due to handling of the materials or sections or hardware during production results in the contamination being sealed within the case.

4.3 Work in Problem Areas

4.3.1 Film Thickness

Reference is made to 4.2.1. To inspect and accept metallized polycarbonate and metallized polysulfone film which when rolled will result in a section which is of the correct diameter for insertion into the metal case and which will be satisfactory from the standpoint of important electrical parameters, it is necessary to establish criteria for thickness of the film. For this production engineering measure and for the size and voltage rated capacitors incorporated therein the nominal thickness are .24 and .50 mils for 100V and 200VDC ratings respectively. The tolerance allowed is minus .02 mils and plus .03 mils for the 24 gauge and ± .05 mils for the 50 gauge. When rolled or wound into a section of multiple turns, the thin and thick areas tend to average out to a predictable resultant section size. The minimum thicknesses of

.22 and .45 mils are adequate to withstand the required voltage stresses both name plate rated and surge.

4.3.2 Film Metallization - Resistance

Reference is made to 4.2.2. The ohmic resistance of the metallization affects the performance of the finished capacitors. Thin metallization will result in high ohmic resistance and the I^2R losses in the electrodes will cause section heating. Thin metallization increases the difficulty of making low resistance contact to the ends of the section during the end spray and lead attachment process in manufacturing. Poor contact can result in high dissipation factor and even eventual loss of end contact during application life of the capacitor. Thick metallization increases the probability that clearing in areas with low voltage stress capability will be incomplete with inadequate vaporization of metal around punch-through areas thus making the capacitor susceptable to additional clearings in that same area under added stresses. Incomplete clearing may leave semi-conductive residuals surrounding the punch-through point or area which could result in serious degradation of the insulation resistance of the capacitor. For this Production Engineering Measure it was determined that an acceptable resistance for the metallized film was in the range of 1.0 to 2.0 ohms per square. The process was specified accordingly.

4.3.3 Film, Clear Margin

Reference is made to 4.2.3 Figure 1 showing the typical configuration of the concentrically wound capacitor films discloses

that the cleared margin along one edge of each film provides necessary flash over insulating area between the adjacent films. This also permits the attachment of the end lead to the uncleared edge of each metallized film respectively without the possibility of inadvertently contacting the metallization of the other film which would result in a short circuit of the device. Consequently it was necessary to establish a minimum and maximum on the cleared edge area or width. The minimum selected insured adequate insulation to prevent flash over at maximum voltage stress and the maximum selected would permit winding sections to a specified number of turns resulting in a section with capacitance within the nominal ±10%. It can be observed that too wide a margin would decrease the total active area of the electrodes for a specified number of turns in winding with a low capacity section as the result. For this Production Engineering Measure, the clear margin was specified as .062 ± .02 inches.

4.3.4 Film, Slit Edges

Reference is made to 4.2.4. Acceptable roughness or minute tears along the slit metallized edge of the metallized polycarbonate or polysulfone film is a factor which has been determined through experience gained in working with sate-of-the-art metallized film and manufacturing processes. The inspection performed is subjective based on the experience factor with previous acceptable and unacceptable edge conditions. The inspection may be both visual and tactile. Smooth

edges acceptable for use appear shiny and reflect light whereas rough edges appear dull and reflect much less light. This is best checked by viewing the edge surface of the multiple turns in roll form. Relative smoothness of the edges may be felt by lightly passing the finger over or along the edges. However, to avoid contamination of materials by skin excretions the amount of such handling or tactile inspection must be minimized or such inspection rolls not used for high reliability capacitors.

4.3.5 Film Defects

Reference is made to 4.2.5. Defects in the metallized film as received are subjectively acceptable provided that there is not an excessive number observed. In particular, with such films defects occur in two classes: the first is the appearance of pin holes through the film, and the second is included foreign particles particularly those which are semi-conductive. Either of these classes of defects will usually result in a non-catastrophic clearing when the wound section is exposed to a voltage low enough not to result in massive destruction of film and electrode areas but high enough to breakdown or punch-through at the hole or particulate area. Such clearing may typically be accomplished by the application of a voltage approximately 10% higher than the maximum voltage the capacitor will see in use or test, and such voltage is applied until the audible "snaps" of the break through clearing are no longer heard or voltage fluctuations of the clearing voltage applied to the capacitor

sections ceases. An excessive number of clearings could result in degradation in insulation resistance or low capacity of the section. In either case the section would be discarded. The visual inspection of the film as received is of necessity subjective. If a hole defect were observed upon unrolling a length of film from the bulk roll, additional lengths of film would be removed and inspected for repetition of the hole which could be indicative of damage caused during the slitting operation at the plant of the supplier. Such repetative holes throughout the roll would be cause for rejection of that roll. However, for the most part, the holes are so small as intrinsic defects and the foreign particles so invisible to usual visual inspection that the clearing specified as a part of the production process for high reliability metallized film capacitors reveals the relative presence of such defects.

4.3.6 <u>Heat Treatment</u>

Reference is made to 4.2.6. The trace quantities of residual products of the manufacturing process of the bulk film generally of most concern when the metallized film is wound into capacitor sections are those of the solvent system and absorbed moisture. In so far as possible it is essential that these elements which constitute contaminants in a viable capacitor be removed from the film. Presence of these contaminants could result in low or degraded insulation resistance or short life catastrophic failure of the capacitor, due either to short circuit or

degradation and loss of end termination resulting in an open circuit. In this Production Engineering Measure an effective heat treatment of the wound section was developed by a matrix program of time and temperature exposure. Five (5) test groups comprised the matrix and selection of the best combination of time and temperature ambients was effected on the basis of comparative measurements of the electrical parameters. The heat treatments selected on the comparative basis and engineering evaluation were:

Polycarbonate - 20 hours at 125°C in air.

Polysulfone - 12 hours at 150°C in air.

The times allowed were adequate for entrapped solvents or moisture to work their way out of the film. The temperature of 125°C was consistent with the maximum operating and test temperature of the finished polycarbonate capacitor.

The temperature of 150°C was consistent with the higher temperature capability of the polysulfone dielectric. Shrinkage of the section film was achieved at a sufficiently high temperature so that no additional shrinkage would occur when the finished capacitor was exposed to 125°C for application life or the 10,000 hour test interval. The section heat treatment thus developed was incorporated into the process specification for this Production Engineering Measure.

4.3.7 Mechanical Construction

Reference is made to 4.2.7. Long term protection from the ambient environment is necessary to insure long life of the capacitor. In this Production Engineering Measure the required protection was achieved by the assembly of the capacitor section with leads attached into a metal case mechanically in conformance with the dimensions of each part as specified in SCS-301. Glass-to-metal seals were soldered into the ends of the case with the section leads emerging through each insulated metal eyelet respectively. One eyelet was solder sealed to the lead at that end.

To provide the shock and vibration cushion for the enclosed section, the assembly was immersed in a vacuum chamber in a bath of unpolymerized resin and a vacuum drawn. When the vacuum was released the resin completely filled the internal voids in the assembled unit. Capacitors were removed from the bath and the resin in the assembly was polymerized or cured at a temperature of 85°C maximum. After the cure, the remaining open eyelet was solder sealed to the lead. Thus the section was sealed off from the ambient environment and cushioned by the cured resin to withstand shock and vibration.

4.3.8 Radiographic Inspection

High reliability capacitors must be properly assembled with the internal positioning of the section oriented to the can configuration

and good soldering of the seals and eyelets with no foreign particles such as bits of metal or solder included within the case. To assure this, all capacitors were subjected to Radiographic Inspection (X-Ray) of sufficient definition to determine that they were free from such defects. Two views were taken perpendicular to the terminal axis. After the first view, capacitors were rotated 90 degrees for the second view. An image-quality indicator at least 10% smaller than the smallest defect to be detected was included with each exposure. Images were evaluated with a magnifying glass of 10X magnification. Any capacitor with a detected defect was rejected.

4.3.9 Film Handling and Storage

Reference is made to 4.2.8. Metallized polycarbonate and metallized polysulfone films used in high quality capacitors must be protected from contamination at all times since such contamination will result in degradation of electrical parameters and catastrophic failure with time. At all stages of the manufacturing process starting with the film as received and inspected, protection from environmental contaminants including skin contact must be avoided. Film materials are handled with gloved hands during winding and section handling. All film is stored in sealed plastic bags until used in fabrication. In particularly sensitive stages of the manufacture, the operators wear protective dust free gowns and caps. Housekeeping is consistent with and approved under

the requirements of MIL-STD-790 for the control of process for the manufacture of established reliability capacitors and electronic devices.

4.4 Conclusions

4.4.1 Metallized Polycarbonate Capacitors, Military Specifications

Metallized polycarbonate film capacitors manufactured in accordance with the processes and controls delineated in paragraphs 4.1, 4.2 and 4.3 will meet the requirements for Established Reliability capacitors as covered by MIL-C-39022 and SCS-301. The transfer of the basic requirements of MIL-C-39022 and SCS-301 into a viable Military specification covering metallized polycarbonate film capacitors has been accomplished. Much of the parameter limit requirements of MIL-C-39022/10 covering DC rated metallized polycarbonate film capacitors was predicated on the work performed under this Production Engineering Measure. Sprague Electric Company has achieved qualification to the /10 document and the capacitor product envisioned in SCS-301 is available for use in military systems. Refer to Table XXXVIII which is a copy of that slash sheet. In addition, similar metallized polycarbonate film capacitors have been characterized in MIL-C-39022/9 and MIL-C-83421. The Sprague Electric Company is qualified to "P" (a FR of .1% per 1000 hours) level under both specifications. In addition, the Sprague Electric plant is regularly inspected by inspectors of the Defense Electronics

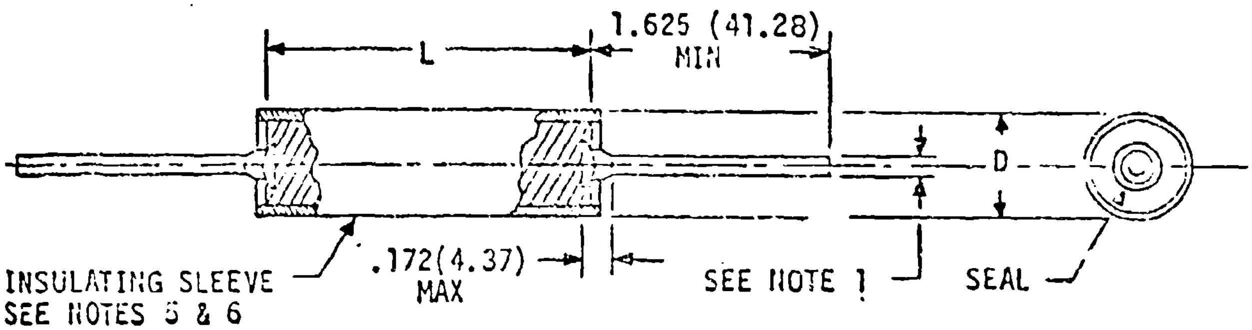
TABLE XXXVIII

MILITARY SPECIFICATION SHEET

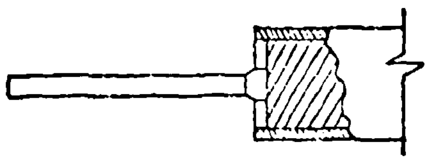
CAPACITORS, FIXED, METALLIZED-PLASTIC FILM DIELECTRIC, DIRECT CURRENT, (HERMETICALLY SEALED IN METAL CASES), ESTABLISHED RELIABILITY

Style CHR10 (insulated)

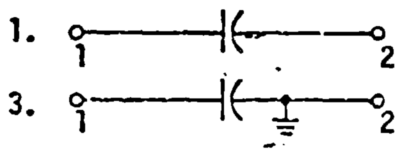
The complete requirements for procuring the capacitors described herein shall consist of this document and the latest issue of Specification MIL-C-39022.



CASE FOR CIRCUIT 1



CASE FOR CIRCUIT 3



CIRCUIT DIAGRAM

NOTES:

1. Number 24 AWG wire for case diameters of .175 (4.45 mm) and .195 (4.95 mm). Number 22 AWG wire for case diameters of .235 (5.97 mm) and .312 (7.92 mm). Number 20 AWG wire for case diameters of .400 (10.16 mm) and over. (See Table 1 for exceptions.) Number 18 AWG wire: See Table 1.
2. See Table 1 for additional dimensions.
3. Dimensions are in inches.
4. Metric equivalents (to the nearest .01 mm) are given for general information only, and are based upon 1 inch = 25.4 mm.
5. Insulating sleeve shall extend beyond the capacitor body but shall not exceed .031 (.79 mm) inch on either end. Insulating sleeve thickness shall not exceed .016 (.41 mm) inch.
6. Plastic insulating sleeve shall be transparent; marking shall be placed on the capacitor case.
7. Metric equivalents are in parentheses.

FSC 5910

Requirements:

Dimensions and Configuration: See Figure and Table 1.
Case material: Nonmagnetic
Capacitance Value: See Table 1.
Capacitance Tolerance: 1 percent, 2 percent, 5 percent, and 10 percent
Rated Voltage: See Table 1 for 85°C rating; derate to 60 percent of 85°C rating for operation at 125°C.
Dielectric material: Normally polycarbonate.
Operating Temperature Range: -55° to +125°C.
Failure Rate Level: M(1.0%), P(0.1%), R(0.01%), S(0.001%).
DC Burn-in: in accordance with MIL-C-39022, Table III, Qualification Inspection, Group 1, and Table IV, Group A Inspection, Subgroup 1, except 140 percent of DC rated voltage shall be applied for 48 hours minimum at +125° +4, -0°C. 100 percent inspection required.
Dielectric Withstanding Voltage (DWV): Method 301 of MIL-STD-202; 100 percent inspection required following DC burn-in.

Terminal to Terminal:

AC: 100 ±10 Hz square wave, peak-to-peak voltage, three times DC rated voltage for 60 seconds minimum, but need not exceed 800 V peak-to-peak. Square wave signal shall have a rise time of 10 to 100 microseconds and a maximum overshoot of 20% of rated peak voltage.

DC: 200 percent of DC rated voltage for 60 seconds, minimum.

Terminals to Case (when case is not a terminal): Same requirements as specified for terminal to terminal DC DWV Test.

Radiographic Inspection (X-Ray): Method 209 of MIL-STD-202 (Required for FR levels R and S only).
Thermal Shock: Method 107 of MIL-STD-202, Condition A, except Step 3 shall be +125° +4, -0°C.
Seal: Method 112 of MIL-STD-202, Condition A, except at +125° +4, -0°C, 1 hour with no evidence of leakage.
Insulation Resistance (IR): Method 302 of MIL-STD-202.
Terminal to Terminal - See Table 3.
Terminal to Case (when case is not a terminal) - 50,000 megohms, minimum.
Capacitance (CAP): Method 305 of MIL-STD-202.
Dissipation Factor (DF):
At 25°C - 0.25% maximum
At 85°C - 0.40% maximum
At 125°C - 0.60% maximum

Table 1. Capacitor characteristics and dimensions

DC Rated Voltage	Cap Value in µf	Dimensions, Nominal D +.015, -.005	L ±.031
50	.047	.174	.531
	.056	.174	.531
	.068	.174	.625
	.082	.174	.625
	.10	.174	.625
	.12	.174	.625
	.15	.193	.625
	.18	.193	.625
	.22	.235	.625
	.27	.235	.625
	.33	.312	.625
	.39	.312	.625
	.47	.312	.625
	.56	.312	.625
	.68	.312	.843
	.82	.312	.843
	1.0	.312	.843
	1.2	.400	.843
	1.5	.400	.843
	1.8	.400	.843
	2.0	.400	.843
	2.2	.400	1.125
	2.7	.400	1.125
	3.0	.400	1.125
	3.3	.400	1.125
	3.9	.500	1.125
	4.7	.500	1.125
	5.0	.500	1.125
	5.6	.500	1.125
	6.8	.562	1.125
	8.2	.562	1.312
	10.0	.670	1.312
	12.0	.670	1.312
	15.0	.750	1.375
	18.0	.750	1.375
	20.0	.750	1.625
	22.0	.750	1.625

See footnotes at end of table.

Table 1. Capacitor characteristics and dimensions (cont'd)

DC Rated Voltage	Cap Value in µf	Dimensions, Nominal D +.015, -.005	Dimensions, Nominal L ±.031
100	.01	.174	.625
	.012	.174	.625
	.015	.174	.625
	.018	.174	.625
	.022	.174	.625
	.027	.174	.625
	.033	.174	.625
	.039	.174	.625
	.047	.193	.625
	.056	.193	.625
	.068	.235	.625
	.082	.235	.625
	.10	.235	.688
	.12	.235	.688
	.15	.312	.625
	.18	.312	.625
	.22	.312	.688
	.27	.312	.688
	.33	.312	.812
	.39	.312	.812
	.47	.400	.688
	.56	.400	.812
	.68	.400	.812
	.82	.400	.938
	1.0	.400	.938
	1.2	.500	.938
	1.5	.500	.938
	1.8	.500	1.125
	2.0	.500	1.125
	2.2	.500	1.125
	2.7	.562	1.312
	3.0	.562	1.312
	3.3	.562	1.312
	4.0	.562	1.562
	4.7	.670	1.312
	5.0	.670	1.312
	5.6	.670	1.312
	6.8	.670	1.562
	8.2	.670	1.812
	10.0	.750	1.812
	12.0	.750	1.812
	15.0	1.000	1.875
	18.0	1.000	1.875
	[illegible]	1.000	1.875
	22.0	1.000	1.875

Case size of 1" dia uses #18 AWG leads.

See footnotes at end of table.

Table 1. Capacitor characteristics and dimensions (cont'd)

DC Rated Voltage	Cap Value in µf	Dimensions, Nominal D +.015, -.005	L ±.031
200	.01	.174	.625
	.012	.174	.625
	.015	.174	.625
	.018	.193	.625
	.022	.193	.625
	.027	.235	.625
	.033	.235	.625
	.039	.235	.688
	.047	.235	.688
	.056	.312	.625
	.068	.312	.625
	.082	.312	.688
	.10	.312	.688
	.12	.312	.812
	.15	.312	.812
	.18	.400	.688
	.22	.400	.812
	.27	.400	.812
	.33	.400	.938
	.39	.400	.938
	.47	.400	1.125
	.56	.400	1.312
	.68	.500	1.125
	.82	.500	1.125
	1.0	.562	1.125
	1.2	.562	1.312
	1.5	.562	1.312
	1.8	.562	1.812
	2.0	.562	1.812
	2.2	.562	1.812
	2.7	.670	1.562
	3.0	.750	1.562
	3.3	.750	1.812
	4.0	.750	1.812
	4.7	.750	2.062
	5.0	.750	2.062
	5.6	.750	2.312
	6.0	.750	2.312
	7.0	1.000	1.812
	8.2	1.000	2.062
	10.0	1.000	2.312

Case size of 1" dia for 8.2 mfd and 10 mfd uses #18 AWG leads

See footnotes at end of table.

Table 1. Capacitor characteristics and dimensions (cont'd)

DC Rated Voltage	Cap Value in µf	Dimensions, Nominal D +.0[illegible], -.005	Dimensions, Nominal L ±.031
400	.01	.235	[illegible]
	.012	.235	.812
	.015	.235	.812
	.018	.235	.812
	.022	[illegible]	[illegible]
	.027	[illegible]	[illegible]
	.033	.312	[illegible]
	.039	[illegible]	[illegible]
	.047	.400	.81[illegible]
	.056	.400	.812
	.068	.400	.938
	.082	.400	.938
	.10	.400	1.125
	.12	.400	1.312
	.15	.400	1.312
	.18	.562	1.125
	.22	.562	1.125
	.27	.562	1.312
	.33	.562	1.562
	.39	.562	1.562
	.47	.562	1.812
	.56	.670	1.562
	.68	.670	1.812
	.82	.750	1.812
	1.0	.750	2.062
	1.2	1.000	1.812
	1.5	1.000	1.812
	1.8	1.000	2.062
	2.0	1.000	2.062
	2.2	1.000	2.312
	2.5	1.000	2.562
	2.7	1.000	2.562

See footnotes at end of table.

Table 1. Capacitor characteristics and dimensions (cont'd)

DC Rated Voltage	Cap Value in µf	Dimensions, Nominal D +.015, -.005	L ±.031
600	.01	.312	.812
	.012	.312	.812
	.015	.400	.812
	.018	.400	.812
	.022	.400	.812
	.027	.400	.937
	.033	.400	.937
	.039	.400	1.125
	.047	.400	1.125
	.056	.400	1.312
	.068	.400	1.312
	.082	.562	1.125
	.10	.562	1.125
	.12	.562	1.312
	.15	.562	1.312
	.18	.562	1.562
	.22	.562	1.812
	.27	.670	1.562
	.33	.670	1.812
	.39	.670	1.812
	.47	.750	1.812
	.56	.750	2.062
	.68	.750	2.312
	.82	1.000	1.812
	1.0	1.000	2.062

1/ Dimensions are bare case sizes (see figure).

2/ Dimensions are for Circuit 1. For Circuit 3, deduct .062" from length.

3/ See Table 2 for metric equivalents.

Table 2. Metric Equivalents of Decimal Inches 1/

Inches	MM	Inches	MM	Inches	MM
.005	.13	.670	17.02	1.562	39.67
.015	.38	.688	17.48	1.624	41.25
.031	.79	.750	19.05	1.812	46.02
.175	4.45	.812	20.62	1.874	47.60
.195	4.95	.874	22.20	2.062	52.37
.235	5.97	1.000	25.40	2.124	53.95
.312	7.92	1.062	26.97	2.312	58.72
.400	10.16	1.124	28.55	2.374	60.30
.500	12.70	1.312	33.32	2.562	65.07
.562	14.27	1.374	34.90	2.624	66.65

1/ Metric equivalents (to the nearest .01 millimeter) are given for general information only, and are based upon 1 inch = 25.4 mm.

Table 3. Insulation Resistance

In Megohms:	
At 25°C ±3°C (need not exceed)	250,000
At 85°C +4, -0°C (need not exceed)	25,000
At 125°C +4, -0°C (need not exceed)	15,000
In Megohms X Microfarads (minimum):	
At 25°C ±3°C	100,000
At 85°C +4, -0°C	6,000
At 125°C +4, -0°C	1,000

Barometric Pressure (reduced): Method 105 of MIL-STD-202, Condition D (100,000 feet). 125 percent of rated voltage applied. See MIL-C-39022 for voltage limitations.

Vibration, High Frequency: Method 204 of MIL-STD-202, Condition D (20G). 50 percent of rated voltage applied.

Salt Spray (corrosion): Method 101 of MIL-STD-202, Condition B (48 hours). Salt solution - 5 percent.

Immersion: Method 104 of MIL-STD-202, Condition C.

DWV:

Insulating sleeves - 4000 VDC, minimum.
Terminal to terminal - 150 percent of rated voltage.
Terminals to case (when case is not a terminal) - 200 percent of rated voltage.

IR:

Insulating sleeves - 100 megohms, minimum.
Terminal to terminal - 60% of value specified in Table 3.
Terminals to case (when case is not a terminal) - 30,000 megohms, minimum.

CAP: Within ±3% of initial value.

DF: Not more than 110% of initial li[illegible]

Solderability: Method 208 of MIL-STD-202.

Shock (Specified pulse): Method 213 of MIL-STD-202, Condition I. 50 percent of rated voltage applied.

Moisture Resistance: Method 106 of MIL-STD-202. DWV, IR, CAP, and DF - Same as for immersion.

Terminal Strength: Method 211 of MIL-STD-202, Conditions A and D.

Condition A - Applied force 5 pounds
Condition D - 3 rotations of 360 degrees

Low Temperature and CAP change with Temperature:

Low Temperature: -55° +0, -3°C for 48 ±4 hours with rated voltage applied.

CAP change with Temperature:

At -55° +0, -3°C : +0, -2%
At +85° +4, -0°C: ±1%
At +125° +4, -0°C: ±2%

Fault Count: Not applicable.

Fungus: Method 508 of MIL-STD-810, Procedure I.

Resistance to Soldering Heat: Method 210 of MIL-STD-202, Condition B (260 ±5°C for 10 ±1 seconds).

IR: See Table 3

CAP: Within ±3 percent of initial value

DF: Not more than initial limit

Life: Method 108 of MIL-STD-202.

Qualification:

Accelerated Conditions: 140 percent of rated voltage for 2000 +72, -0 hours at 85°C. End of life requirements as specified for rated conditions.

Rated Conditions: 100 percent of rated voltage for 10,000 +96, -0 hours at 85°C.

DF (at 85°C +4, -0°C) between first 24 and 48 hours of test: Not greater than initial limit.

DF (at 85° +4, -0°°C) during last 48 hours of test: 0.8 percent, maximum.

IR:

Insulating sleeves - 100 megohms, minimum

Terminal to terminal - not less than 30,000 megohm-microfarads or 75,000 megohms

Terminals to case (when case is not a terminal) - 30,000 megohms, minimum.

CAP: Within ±5 percent of initial value.

DF (at +25 ±3°C) after Life: 0.5 percent maximum.

Extended Life:

Accelerated Conditions: 2,000 +72, -0 hours.

Rated Conditions: 10,000 +96, -0 hours.

IR, CAP, and DF - Same requirements as for qualification Life Test.

- 125°C Verification Life Test: 85°C rated voltage for 2,000 +72, -0 hours at 125°C. 25 pieces representative of production shall be tested every six months.

  IR, CAP, and DF - Same requirements as for qualification Life Test.

Marking: In accordance with MIL-C-39022

Part Number: M39022/10 - (Type designation as detailed below)

Explanation of Type Designation:

M39022/10 - A 104 G M

- M — Failure rate level in percent per 1000 hours: M = 1.0%, P = 0.1%, R = 0.01%, S = 0.001%
- G — Capacitance Tolerance: K = ±10%, J = ±5%, G = ±2%, F = ±1%
- 104 — Capacitance: Expressed in picofarads. The first two digits are significant figures; the third is the number of zeros to follow.
- A — Circuit and voltage code (see Table 4).

Table 4. Circuit and Voltage Codes

CODE	CIRCUIT	VOLTAGE
A	1	50
B	3	50
C	1	100
D	3	100
E	1	200
F	3	200
G	1	400
H	3	400
J	1	600
K	3	600

Preparing Activity:
NAVY-EC

Supply Center, Dayton, Ohio for compliance with the Established Reliability specifications cited, and the Process Control Standard MIL-STD-790, with continued qualification.

4.4.2 Metallized Polsyulfone Capacitors, Military Specifications

The metallized polysulfone film capacitors tested under this Production Engineering Measure exhibited the capability of high reliability as evidenced by the achieved .0056% per 1000 hours failure rate. However, the quality of available polysulfone film continues to be variable resulting in concern for continuous availability of film satisfactory for production use in high reliability capacitors. At this time, there is not a viable MIL specification covering such dielectric capacitors but it is anticipated that such a document will be generated by the Military services and Industry when film availability is achieved and the product need in equipment applications demonstrated. Meanwhile, proprietary product is supplied by the Sprague Electric Company on a custom designed basis for use in Military Systems when OEM specified.

4.5 Process Yields

A breakdown of process yields into losses at each station is presented in Table XXXIX.

Seventy percent of the wound capacitor sections are passed through inspection and are sent to the next operation. Of these, only seventy

TABLE XXXIX

PROCESS YIELDS

Process Step	Loss In Percent
Winding and Quality Assurance Inspection	30.00%

Process Step	Loss In Percent
Heat Treatment	.05
Prepare for Spray	.20
Spray	1.00
Clean	.20
Attach Leads	2.00
Lead Pull Test	1.00
Electrical Testing	12.50
Assembly Enclosures	.10
Solder End Seals	.30
Fill	.05
Final Seal	.20
Clean	.05
Mechanical Inspection	1.00
Seal Test	.30
Electrical Test - Pre Burn-In	6.00
Post Burn-In	5.00
Marking	.05
Total Assembly Losses	30.00%

percent make it through the manufacturing process. Thus an overall yield of 49% is experienced for the metallized polycarbonate capacitor. The same percentages apply to the metallized polysulfone capacitor.

4.6 Equipment and Labor Requirements

The manufacturing needs to produce 3000 subminiature metallized polycarbonate or metallized polysulfone capacitors in one eight hour shift per day are detailed in Table XL. These figures are based on the following rating breakdown per shift.

0.10 mfd - 100 VDC	500 pcs.
1.0 mfd - 100 VDC	500 pcs.
4.0 mfd - 100 VDC	500 pcs.
0.047 mfd - 200 VDC	500 pcs.
0.33 mfd - 200 VDC	500 pcs.
1.0 mfd - 200 VDC	500 pcs.

TABLE XL

MANUFACTURING REQUIREMENTS*

Operation	Equipment	No.	Operators	Area Square Feet
Winding	Winding Machine	6	6	300
Heat Treatment	Ovens	3	1/8	150
End Spray Preparation	None	-	1	100
End Spray	Spray Gun	1	1	200
End Spray Cleaning	None	-	1	100
Lead Attachment	Soldering Devices	2	2	100
100% Electrical Test	Elect. Test Equipment	3	1 1/2	100
Assembly	None	-	1	100
Soldering	Soldering Devices	2	2	200
Filling	Vacuum Equipment	1	2	100
Soldering	Soldering Device	1	1	50
100% Inspect & Seal Test	Seal Test Equipment	2	1 1/2	150
100% Electrical Test	Elect. Test Equipment	3	2	300
** Burn-In	Ovens Power Supplies	1 2	1	200
100% Electrical Test	Elect. Test Equipment	3	2	300
Marking	Stamping Machine	1	1/2	50
Packaging	None	-	1	200
	Total		26 5/8	2700

*Requirements necessary for the manufacture of 3000 Metallized Polycarbonate or Polysulfone Capacitors in one eight hour shift per day.

**Requirements for 250 hour Burn-In of 3000 capacitors.

SECTION 5

CONCLUSIONS

(1) Quality of the metallized polycarbonate and polysulfone film as received is most important in terms of ultimate low failure rate over long life time use of the capacitors. In particular, the uniformity of thickness, specific resistance in ohms per square for the metallization, shrinkage under thermal stresses, solvent or foreign particulate entrapment, and smoothness of slitting together with an adequate and uniform cleared margin area are all factors which must be controlled by incoming inspection and evaluation.

(2) Shrinkage of film wound into sections through exposure to thermal stress at or somewhat above the maximum operating temperature of the finished capacitor is required for stability of parameters and high reliability.

(3) Heat treatment of the wound section is essential to effect mechanical stabilization under high temperature use. This operation is necessary in order to shrink the metallized film and remove the

volatile entrapped solvents. Temperature selected must be equal to or somewhat above the rated operating temperature of the finished capacitor.

(4) All polycarbonate and polysulfone film contains minute amounts of the solvent system used in the manufacturing process of the film. This must be removed to the maximum extent possible by the application of thermal stresses sufficient to release the volatile components of the system from the film. The length of time that the wound section is exposed to the thermal stress necessary to achieve this objective is dependent on the amount of entrapped solvent and the thickness of the film used. It is essential that characteristics of a supplier's film be determined, and adequate heat treatment developed. Continuous monitoring of lots through incoming inspection and evaluation is required. Less than satisfactory removal of the solvent system residuals will result in a time/temperature degradation of the electrical parameters of the finished capacitor.

(5) Application of a burn-in to the finished capacitor is essential to remove from the population the capacitors with short life factors as either the result of intrinsic degradation factors randomly observed throughout films or possible minor damage to the section during the manufacturing and handling phase in production. Typically, burn-in which is usually a voltage stress over the maximum rating

of the capacitor is applied for a time duration chosen to develop short term degradation of electrical parameters at the highest rated temperature. Such a burn-in has been demonstrated to be the application of 140% of rated voltage for 250 hours at 125°C during the process improvement phase of this Production Engineering Measure.

(6) Because polycarbonate and polysulfone films are exceedingly sensitive to the effects of ambient moisture resulting in unacceptable degradation of the electrical parameters of the capacitor, usually observed as a significant drop in insulation resistance, it is necessary to insure hermeticity by the use of glass-to-metal seals soldered into tubular metal section housings or cases. This method of construction was used on all parts tested under this Production Engineering Measure.

(7) Plastic film capacitors are damaged by exposure for eve relatively brief intervals to temperatures in excess of the maximum rated operating temperature of the device. This is due to the initial intrinsic characteristics of the film and the maximum operating temperatures established by the process in terms of section film shrinkage temperatures used during the manufacturing process. Metallized plastic film capacitors should never be exposed to or used in application at temperature in excess of the specified rating.

(8) Based on the factors of experience gained during the performance of this program and consistent with the state-of-the-art relative to metallized polycarbonate film available from suppliers and manufacturing techniques, Slash sheets have been added by the Military Departments to MIL-C-39022. Most representative of the capacitor manufactured and tested under this Production Engineering Measure is MIL-C-39022/10 (EC). Similar is MIL-C-39022/9 (USAF) and MIL-C-83421 (USAF).

(9) Metallized polycarbonate film capacitors manufactured under the proper process controls are capable of high reliability performance and low failure rate. Capacitors manufactured under this Production Engineering Measure demonstrated an extrapolated intrinsic failure rate of .001% per 1000 hours; but due to the contract modification reducing the number of metallized polycarbonate capacitors from 23,000 to 11,500, the achieved failure rate was calculated as .002% per 1000 hours at 90% confidence level.

(10) Metallized polysulfone film capacitors manufactured under the proper process controls are also capable of high reliability performance and low failure rate. The experience gained during the performance of this contract indicate the need for improvement in the state-of-the-art relative to the consistency of quality of the metallized polysulfone film available from suppliers.

As a result of test equipment malfunction, the production lot test was terminated prior to the 10,000 hour end point. The achieved failure rate was calculated as .0056% per 1000 hours at 90% confidence level.

SECTION 6

PROGRAM RECOMMENDATIONS FOR ADDITIONAL EFFORT

(1) With the successful conclusion of the test program demonstrating that high reliability metallized polycarbonate film capacitors could be produced by a state-of-the-art capacitor manufacturer using domestic source film it is apparent that no additional work effort or funding is required to produce either film or capacitor product.

(2) Specification sheets have now been issued to MIL-C-39022 as /9 and /10 covering several variations of hermetically sealed metallized polycarbonate film and an additional specification MIL-C-83421 recently has been issued covering metallized polycarbonate film capacitors.

(3) The Sprague Electric Company has qualification to Level "P", .1% per 1000 hour failure rate, and supplies Established Reliability Capacitors using metallized polycarbonate film for military systems applications.

(4) This Production Engineering Measure demonstrated that polysulfone film as received is capable of providing long life reliable capacitors. However, lot uniformity has not been achieved and it is necessary that each lot be extensively evaluated before being used in quality capacitor construction. Additional basic film process work should be programmed to develop product uniformity. Additional effort should be programmed in developing the best capacitor manufacturing techniques.

SECTION 7

CONFERENCES, PUBLICATIONS AND REPORTS

7.1 Monthly Reports

A total of eighty-seven monthly reports were prepared, submitted, approved and distributed during the contract period.

7.2 Quarterly Reports

Twenty-eight Quarterly Reports were prepared, submitted, approved and distributed during the contract period.

7.3 PERT Chart

A PERT Chart covering the work to be performed under this contract was prepared, submitted to and approved by USAECOM on September 11, 1967.

7.4 Inspection and Quality Control Plan

An Inspection and Quality Control Plan was submitted to and approved by USAECOM on June 9, 1970.

7.5 First Article Test Reports

The First Article Test Report for Polycarbonate Capacitors was submitted to USAECOM on May 19, 1970 and approved on June 16, 1970.

The First Article Test Report for Polysulfone Capacitors was submitted to USAECOM on March 5, 1973. Approval of this report was received on March 20, 1973.

7.6 Conferences

A Post-Award Conference was held on the PEM Program for Reliability Improvement of Metallized Polycarbonate Capacitors at the Sprague Electric Company's Dearborn Facility in Orlando, Florida on July 13, 1967. Attending the meeting were:

Government Representatives	Sprague Electric Company
Mr. R Thompson	Mr. E. D. A. Geoghegan
Mr. M. Sullivan	Mr. D. H. Smith
Mr. S. Levy	Mr. R. S. Boyles
Mr. R. Heuermann	Mr. J. H. Michels
Mr. E. M. Soloman	
Mr. S. M. Bernstein	
Mr. W. A. McGurk	
Mr. J. A. Smalley	
Mr. R. J. Weber	

On November 21 and 22, 1968 a conference was held at the Dearborn Facility for the purpose of discussing the progress of the program. Attendees at this meeting were:

Government Representatives	Sprague Electric Company
Mr. R Thompson	Mr. E. D. A. Geoghegan
Mr. D. Pain	Mr. D. H. Smith
	Mr. R. S. Boyles
	Mr. J. H. Michels

On January 10, 11 and 12, 1973 a technical meeting was held to review the status of the contract items and problems related thereto. The meeting were held at Sprague Electric Company's Dearborn Facility at Orlando, Florida and the following were in attendance:

Government Representatives	Sprague Electric Company
Mr. R. Thompson	Mr. W. Lamphier
Mr. R. Joiner	Mr. J. Michels
	Mr. H. Pentecost
	Mr. D. Smith
	Mr. D. Dicks

SECTION 8

DISTRIBUTION LIST

Copies	
1	Director Electronics Components Laboratory Fort Monmouth, New Jersey 07703 ATTN: AMSEL-KL-E (Mr. H. Stout)
1	Commanding General U. S. Army Electronics Command Fort Monmouth, New Jersey 07703 ATTN: AMSEL-PP-EM (Mr. F. Hochberg)
1	Commander Rome Air Development Center Griffiss Air Force Base, New York 13442 ATTN: Mr. D. F. Barber
12	Commander Defense Documentation Center Cameron Station Alexandria, Virginia 22314 ATTN: TISIA-1
2	U. S. Army Electronics Command Green Acres Building Fifth Floor, OA Fort Monmouth, New Jersey 07703 ATTN: AMSEL-PP-I-P-I-1 (Mr. Arthur Rabin)

Copies	
1	Department of the Navy Naval Electronics Systems Command Washington, D. C. 20360 ATTN: Mr. Leon Neal, Code 051432
1	NASA Goddards Space Flight Center Quality Assurance Branch Greenbelt, Maryland 20371 ATTN: Mr. H. Lunchick, Code 323
1	Cornell-Dubilier Electric Corporation 1605 Rodney-French Blvd. New Bedford, Massachusetts 02744 ATTN: Mr. D. Sylvia
1	General Electric Company P. O. Box 158 Irmo, South Carolina 29063 ATTN: Mr. K. Norwood
1	Nytronics, Inc. Capacitor Division Darlington, South Carolina 29532 ATTN: Warrington L. Williams
1	Aerovox Corporation 740 Belleville Avenue New Bedford, Massachusetts 02745 ATTN: Mr. A. Kalstein
1	Mallory Capacitor Company 3029 Washington Avenue Indianapolis, Indiana 46204 ATTN: Mr. David Bell
1	TRW Capacitor Division 112 West First Street Ogaliala, Nebraska 69153 ATTN: Mr. Loren C. Kolste
1	Gudeman Company 340 West Huron Street Chicago, Illinois 60610 ATTN: Mr. Leo Grimm

Copies	
1	Marshall Industries 1960 Walker Avenue Monrovia, California 91016 ATTN: Mr. James East
1	The Potter Company P. O. Box 337 Wesson, Mississippi 39191 ATTN: Mr. H. Mutz
2	The Advisory Group on Electronic Devices 201 Varick Street New York, New York 10014
1	San Fernando Electric Manufacturing Company 1509 First Street San Fernando, California 91340 ATTN: Mr. Richard Griffiss
1	Erie Technological Products, Incorporated 644 West 12th Street Erie, Pennsylvania 16501 ATTN: Mr. H. S. Herrick
1	Hopkins Engineering Company 12900 Foothill Blvd. San Fernando, California 91342 ATTN: Mr. N. L. Bevan
1	Balco Capacitors Division 307 Washington Street Orange, New Jersey 07050 ATTN: Mr. Dan Feeney
1	Component Research Company, Incorporated 1717 Nineteenth Street Santa Monica, California 90404 ATTN: Mr. D. Kellerman
1	Southern Electronics Corporation 150 West Cypress Avenue Burbank, California 91502 ATTN: Mr. R. W. Koehler

Copies

1	Westinghouse Electric Corporation R&D Center Beulah Road, Churchill Boro Pittsburgh, Pennsylvania 15209 ATTN: Mr. Joseph Engel
1	U. S. Air Force Aeronautical Systems Division Wright-Patterson Air Force Base, Ohio 45324 ATTN: Mr. R. C. Faust, ASNPS-20
1	U. S. Semcor 3540 West Osborn Road Phoenix, Arizona 85019 ATTN: Mr. M. Restivo
1	WESCO Electrical Company, Incorporated 27 Oliver Street Greenfield, Massachusetts 01301 ATTN: Mr. R. Kugell
1	Sangamo Electric Company Eleven South Converse Street Springfield, Illinois 62702 ATTN: Mr. K. McGee
1	Peter J. Schweitzer Division Kimberly-Clark Corporation Lee, Massachusetts 01238 ATTN: Mr. J. W. Tosch

SECTION 9

IDENTIFICATION OF PERSONNEL

9.1 Identification of Personnel

The following is a categorized list of personnel and the hours contributed to the contract.

Personnel	Hours
Engineering	1927.00
Assistant Technical	2645.25
Technical Writing	463.00
Clerical	179.25
TOTAL	5214.50